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PHYSIOLOGICAL NOTES

ON

PRIMARY EDUCATION

AND THE

STUDY OF LANGUAGE

BY

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NOTES ON PRIMARY EDUCATION AND LANGUAGE.

I.

AN EXPERIMENT IN PRIMARY EDUCATION.

In modern times education has been recognized to be something more than an elegant luxury, designed exclusively for the benefit of the "upper classes." It is a force, and a potent and indisputable means, not only for the training but for the evocation of forces. It is able, not only to convey information, but to increase power. It is not simply a social convention, but a real means for attaining real ends. The final ends of education are efficiency and repose. The educated person is he who knows how to get what he wants, and how to enjoy it when he has got it.

When a "higher education" is demanded, for any class of persons—as women,—it means that it has become desirable to train their faculties for more difficult work than that traditionally assigned to them, and also that it is desirable to enable them to get more enjoyment out of any work that they do. The necessary correlative of the possession of powers is the opportunity for their exercise. The existence

of a larger class of effectively educated women must increase their demand for a larger share in that part of the world's work which requires trained intelligence. Of this, literature and other art is one and only one portion. The work of the professions, of the upper regions of industry, commerce, and finance, the work of scientific and of political life, is the work appropriate to the intelligences which have proved themselves equal to a course of training at once complex and severe. A person destined to receive a superior education is expected to develop more vigorous mental force, to have a larger mental horizon, to handle more complex masses of ideas, than another. From the beginning, therefore, he must not merely receive useful information, but be habituated to perform difficult mental operations, for only in this way can the sum of mental power be increased. The order, arrangement, and sequence of the ideas he acquires must be as carefully planned as is the selection of the ideas themselves, because upon this order and internal proportion his mental horizon depends. The child must be trained in feats of sustained attention, and in the collocation and association of elementary ideas into complex combinations. Since ideas are abstractions from sense-perceptions, he must be exercised in the acquisition of accurate, rapid, far-reaching, and delicate sense-perceptions, in their memorization, and in the representative imagination which may recall them at will, and be able to abstract from them, more or less remotely, ideas. Habits of rich associa-

tion of ideas must be formed, and of pleasure in their contemplation. And very early must be offered to the child problems to be solved, either by purely mental exertion, or by that combined with manual labor. And all this care must be taken for girls as well as for boys, so soon as it is seriously agreed that girls may be admitted to a superior as well as to a primary education.

The first intellectual faculties to be trained are perception and memory. The subjects of the child's first studies should therefore be selected, not on account of their ultimate utility, but on account of their influence upon the development of these faculties. What sense is there, then, in beginning education with instruction in the arts of reading and writing? If literature were the main business of life, or if, as was at one time supposed, education meant nothing else but acquaintance with literature, there would be some logic in the extraordinary prominence habitually assigned in education to the study of modes of literary expression. But, from the modern standpoint, that education means such an unfolding of the faculties as shall put the mind into the widest and most effective relation with the entire world of things—spiritual and material,—there is an exquisite absurdity in the time-honored method. To study words before things tends to impress the mind with a fatal belief in their superior importance. To study expression before subjects of thought have been accumulated, is to cultivate the habit, always prevalent

in civilized life, of talking fluently without having any thing to say. To direct attention to sets of arbitrary signs before attention has been trained by contemplation of real objects, teaches the mind to place conventional and contingent facts on the same level with necessary truths. We thus weaken in advance the power of belief in necessity and reality. Without such power the mind becomes inevitably the prey to a skepticism generated much less by contradictions in the outside world, than by the weakness of its internal organism. What other result should logically be produced, when, to the opening mind, as it turns eagerly to the wonderful world in which it awakens and finds itself, we offer for contemplation, exercise, and earliest sustenance, the alphabet, the abstruse structure of words to be spelled, the grammar of sentences to be construed, the complex gymnastics of copies to be written? When to the reading, writing, spelling, grammar, and composition in English, we add that of similar exercises in two or three other languages, we evidently describe the education, first, of the children in our public schools, then of those of the so-called "upper classes"; and show that all is a prolonged study of words.

Words are fossils, which, according to the understanding had of them, are a heap of meaningless stones, or the incarnation of a bygone life. When the child has once learned to handle present existences, he will be prepared to understand the reflec-

tions of a past life in language. When he has had some experience in framing complex abstractions, he can then appreciate the complex abstractions of speech. But, until then, language should not be to him an object of thought, but only an organ of thought. It is not to be driven *into* him, but only *out* of him, through the urgent consciousness that something must be said. The inflections, intonations, and emphasis of speech, uttered or written,—and which include grammar, rhetoric, punctuation, style, —must arise spontaneously, as natural clothing of the idea, which insists upon making itself understood. An idea which is once sufficiently vivid in the child's mind can hardly fail to "climb to a form in the grass and flowers" of picturesque baby-speech.

On this principle it might be useful to precede study of either spoken or written language by study of gestures and signs. At all events, in my own experiment, the child was taught algebraic signs as a means of concisely expressing certain relations, long before any attempt was made to learn how to write. Thus the important, fundamental idea was early conveyed to her mind that all arts of expression were subordinate in importance to the subject expressed. Deliberate study of the arts of expression, which is equivalent to the study of literature, rhetoric, and style, was reserved until after many years of study of things should have accumulated impressions and ideas which spontaneously

sought an outlet. Further, the child was taught to draw in simple combinations of lines for many months before attempting to write. When this difficult and complex muscular exercise was approached, she began it with unusual ease, and in a few weeks, at the age of six, already commanded a firm and legible handwriting. Further, and for the same purpose, no set copy-book was used from which meaningless sentences could be imitated; but the child proceeded at once to utilize the art of writing in precisely the same way that humanity has done in passing from barbarism with spoken traditions, to civilization with a recorded history. She recorded at first with printed, afterward with script characters, the history of a group of hyacinths, whose development she watched from birth to death. The writing, though compelled to be carefully done, was recognized as no end in itself, but as a means to preserve a connected history of a series of interesting events, otherwise liable to lapse into oblivion. The art was thus approached, as all arts should be, from the standpoint of its real genesis, and tended to place itself in the same relative position in the child's mind that it had occupied in the real history of the world.

Study of the pathological conditions of writer's cramp, and of the numerous brain-lesions which have so marvellously dissected the faculty of comprehending verbal and written signs, has revealed a hitherto unsuspected complexity in the muscular movements involved in writing, and of the mental processes

necessary to language.[1] The discovery has not yet modified the glaring crudity of the educational methods which persist in beginning mental training with a forced drill in these complex processes and gymnastics.

Not speech abstractions, the highest conquest of the mind, but the development of the visual conceptions, which are its earliest spontaneous achievement, should be the first object of systematic training. Forms and colors are the elements of all visual impressions; and these are, moreover, susceptible of a scientific classification which can, from the beginning, be rendered appreciable to the child. It is upon forms and colors, therefore, that both perception and memory must first be exercised. The visual impression should be amplified up to the point at which it is able to fix itself on the mind by its own momentum; therefore, without conscious effort. When the mind has accumulated a stock of reminiscences which *cannot* be forgotten, it will, by so much, have enriched its structure and enlarged its furniture. It is then prepared for voluntary efforts at recollection.

The amplification of the impression is effected in two ways: 1. The impression may be associated with an action on the part of the child, as when he arranges building-blocks into definite forms. 2. The

[1] See Kussmaul, "Stoerungen der Sprache"; also Lichtheim on "Aphasia" (*Brain*, January, 1885). The literature on these two subjects is already immense.

outlines of the object itself may be magnified, and at the same time roughened, by being copied with sticks, as may be done in the first attempts at map-drawing. The copy substitutes a schematic outline for the real one, but by the very fact blends a mental conception with the simple visual image. This necessity for amplification is very important, and, as it seems to me, very often overlooked. It is strictly in accordance with the physiological law in neuro-dynamics, that a stimulating impression must vary in intensity inversely to the susceptibility of the nerve-element to be impressed. The more developed and vigorous the mind, the slighter the object that is perceived and remembered; and, as Mr. Froude remarks, men of genius always have tenacious memories. Conversely, the relatively feeble mind of the young child requires a large object to awaken its prehensile faculties. If the memory of children for what has once impressed them is often remarkable, it is because the infantile period of mental development bears much analogy with the character of genius.

It seems to me that for several years no abstract statements should be made to a child, except such as may be, at least schematically, represented by tangible objects, and at every new point of even advanced studies recurrence to such schemas may be usefully made.

Perception and memory should be indissolubly associated. There are two prevalent errors of method

which I have noticed: to expect a child to remember what it has never perceived; and to allow it to perceive without any systematic representation of the object in memory. In the earliest training, contemplation of an object is insufficient to fix its outlines on the mind: it must be handled as well as seen. In my own experiment with a child of four, Froebel's building-blocks were used to construct definite models; but these, once framed, were repeated from memory. Sometimes the details of an exciting story, as that of "Blue-Beard," were associated with the different details of the model, so that these were more vividly remembered.

By building in succession the different rooms in which the various acts of the tragedy were supposed to have occurred, the child learned, on the one hand, mathematical outlines; on the other hand, to remember history by, in a degree, acting history herself. The principle of this method is applicable to much more advanced studies.

President Hill, in his eloquent little book on "The True Order of Studies," emphatically insists on the necessity for a selection of studies which differ widely from the conventional programme. "We awake to consciousness," he observes, "through the fact of motion which reveals to us an outer world, and a universe of space and time in which that world of matter moves. These space and time relations are the earliest objects of distinctly conscious intellection, the first objects concerning which our knowl-

edge takes a scientific form. This was true of the race, and it is true of the individual. Before the child has a clearly intellectual life on any other subjects, it attains a very definite power to distinguish the square, the circle, the oval, the spiral; and also to recognize the rhythm of verse and music. Out of space and time arise through the suggestions of the material world three principal sciences: geometry, arithmetic, algebra. In considering space we are led to imitate the act of the Divine Intellect, which has geometrized from eternity. Geometry is the earliest and simplest of all possible sciences." The writer proceeds to point out that "the earliest abstraction from the idea of form is that of number, and out of this idea is evolved the earliest of the truly abstract sciences, namely, arithmetic. But because this science is based upon an abstraction, and not upon a direct perception, it should be made to follow, and not, as is usually the case, precede geometry." Again, "the earliest suggestions of motion reveal to us time as well as space. But space is external to the mind; time enters into our spiritual consciousness, and measures our flow of thought."

To this might be added the anatomical consideration that the formation of space-conceptions is the function of the cerebrum, from the impressions furnished by the optic nerve; while the conceptions of time are elaborated in the cerebellum from the experience in successions of events furnished by the auditory nerve. Space-conceptions are objective,

static; time-conceptions, from the beginning subjective, are at first successive, then become progressive, finally causal, dynamic—when the conception of cause arises from consideration of the sum of antecedent events. Thus this second series of conceptions soon impinges upon moral considerations; the first remains within the sphere of perceptive intelligence. To space, or optic-nerve conceptions, belongs symmetry; to time, or auditory-nerve conceptions, belong harmony and rhythm.

These ultimate ramifications of the primary psychic phenomenon must be held in mind at the moment of beginning to systematize the visual and auditory perceptions which lie at their basis.

All object-teaching may be made useful as a means of training to independent observation. But the study of ordinary, *i. e.*, of complex objects, is necessarily empirical, whereas geometric forms can be at once submitted to scientific generalizations, can therefore at once initiate the child into scientific method. Dr. Hill recommends the study of geometry to be begun at the age of eight. The child upon which my own experiment was performed began the study of geometric elements before she was four. Some details of her education may perhaps be quoted as the best way of illustrating certain abstract principles. At the age of four and a half she had learned the following elements: straight, curved, slanting, and half-slanting lines; also to distinguish perpendicular and horizontal lines, and to draw either

straight or curved lines parallel to each other. She was well acquainted with all forms of the triangle, equilateral, isosceles, right angled, and scalene. She knew a rectangle and a square, and the relations to each of the slanting and half-slanting line. She knew also, and was especially fond of, the trapezium, trapezoid, the pentagon, hexagon, etc., the circle and semicircle; and, in solid figures, knew the cube and its apparent relations to the square. She did not merely know the names of these things, but to her eye the whole perceptible universe arranged itself spontaneously into these fundamental forms; for she was incessantly disentangling them from the complex appearances of surrounding objects. Thus a horse-railroad interested her as an illustration of parallel straight lines which never met, the marks of carriage-wheels as parallel curved lines, the marks of horse-shoes, as "dear little curves." She learned that the curved line was the line of living things, and that straight lines belonged exclusively to artificial objects. At dinner she divided her cake into squares or cubes, and made pentagons and octagons with the knives and forks. She learned that by increasing the number of sides a plane figure gradually progressed from a triangle to a circle; and thus, on first seeing a cylinder, at once compared it to a circle, because "it had ever and ever so many sides," and not to a prism, with which the superficial resemblance might be supposed to be more striking.

The habit of looking for the forms of things led

the child to the spontaneous observation of the alphabet, which she taught herself by incessantly copying the letters until she was familiar with them.[1] It was at this time that her education devolved upon me, and I began to effect the transition from a simple descriptive study of geometric forms toward some conception of their necessary relations. At first the purely descriptive study of geometric forms was continued, and, for several months and by the help of wooden models, extended from plane to solid figures. Later, when she was five and a half, some necessary relations were taught. Thus the child learned that three was the smallest number of straight lines which could include a space, by building with colored sticks an imaginary fence around a field in which a goat was to be inclosed. It was obvious that, when only two sides of the fence were completed, the goat would be able to run out and wreak all the destruction in the garden which might be anticipated from a reckless and unrestrained goat. An indissoluble association of ideas was thus established between a geometric necessity and the logic of events.

The second axiom taught was the equality of any two objects which were demonstrably equal to the same third. This was learned when the child was five years old; and illustrated in the first place by its applicability to the solution of problems otherwise

[1] This first year of the child's education was carried on in the Kindergarten of Mrs. Walton.

insoluble. Thus if it became necessary to compare the height of two girls, one of whom lived in Syracuse and the other in Boston, but unable to visit each other, a common measure was suggested in the person of a third girl living in New York, of more peripatetic habits, and able to travel from one place to another. By the same device the lesser difficulty was overcome, of comparing the length of a floor and the ceiling of a room through the medium of the wall. Ultimately the problem was illustrated by the less conspicuous mechanisms of colored sticks, and then the first algebraic signs of equality and inequality were taught, thus preceding all knowledge of writing. When the idea had been thus copiously illustrated and perfectly grasped, the verbal axiom ("things equal to the same things," etc.) was, by exception, given, and learned with ease. This was proved by the child's remark on one occasion of applying the axiom: "I knew what I was *thereforeing*." In a similar way were taught some other axioms—thus, that equals being added to equals the wholes are equal, and that the whole is equal to the sum of its parts. The last axiom was illustrated graphically by observation of a large complex fungus which the child happened to pick up during a walk. Each part was apparently independent, yet so inseparable from the whole in which it inhered, and the whole was so obviously composed of these aggregated segments, that the axiom in question seemed to the child simply descriptive of the object.

Thus the mind was early initiated into the recognition of necessary truths, however few, lest otherwise it should never acquire that sense of reality and necessity which is essential to all forcible mental and moral action.

At the beginning of the year, the child being four and a half, the study of elementary colors was added to that of form. It was begun logically with observation of the rainbow. The child was led to notice and distinguish its colors in their regular order, and subsequently to reproduce this order exactly by means of colored sticks. As this was a fundamental observation among those furnished by the universe of things, it was constantly allowed to recur in different combinations in the same way as the original theme of a musical symphony. Thus at first the colored sticks were laid parallel to each other in a simple package. Subsequently the study of form and color was combined by using the same colored sticks to construct angular geometric figures from the triangle to the decagon. Each figure consisted of seven of different sizes and colors, placed concentrically to each other in the rainbow order. After several months a third complication was introduced, by imagining that each color represented a lineal bed of flowers, the flowers having been previously gathered by the child and their colors compared. At this time solid figures would be placed in the centre of the innermost plane figure outlined by the sticks, thus bringing out clearly the relations

of the sides of such solids to certain planes. Thus a cube would stand in a square, a tetrahedron or pyramid in the centre of a triangle. This last case offered the occasion for a somewhat wide reach of fancy; for pictures were shown exhibiting pyramids in the Egyptian Desert, to imitate which the table was strewed with sand. Then the different triangles were outlined with sticks, representing successive beds of flowers breaking the desolation of the desert,—thus, roses and pinks, then marigolds, then yellow snap-dragons, jonquils, and laburnums; then a bed of green leaves, another of periwinkles and blue-bells, a sixth of hyacinths, and a seventh of violets. Thus the entire exercise embraced conceptions of form, and of the relations of plane to solid geometric figures; conceptions of color; discovery of the origin of these in a grand cosmic phenomenon; utilization of colors as one means of classification in a new science, that of botany; impressions of beauty from the actual color combinations, and from reference, partly actual, partly from memory, to the lovely flowers suggested; finally, a large imagination of a distant land more or less distinctly suggested by the picture. The exercise was thus both orderly and complex; it required a prolonged effort of sustained attention, and implied the association of quite a number of different ideas into a single massive conception. Finally, none of these ideas were represented by a verbal formula, but each as the scarcely removed abstraction from a tangible object that the child

could freely handle. The exercise was thus a typical illustration of the methods which I have defined as suited to develop a higher order of intellectual capacity.

The second step in the study of cosmic phenomena, which had been begun by observation of the rainbow, consisted in the study of the points of the compass. The child was first taught to construct, from Kindergarten tablets, figures which might serve to indicate the points of the compass; afterward she was obliged to recognize these points out-of-doors by reference to the rising and setting sun. Every morning she ascertained the direction of the winds and waves. She was then taught the points on a real compass, and how to direct her country walks by means of this instrument. This was her first initiation into the use of instruments of precision. It was gradually extended during the year by means of practical experiments with the mathematical compass, ruler, spirit-level, pulley, wedge, and balance. The use of the last instrument, together with that of practical measures, greatly simplified and abridged the labor ordinarily devoted in arithmetic to learning about weights and measures. The child was taught the metric system first, because it was logical, because it assimilated readily with American decimal currency, and because the mutual interconversion of weight and capacity, practically demonstrated—*e. g.*, by showing that a cubic centimetre of water weighed a gramme,—prepared the way for the great idea, to come later, of

scientific correlations. The English weights and measures were learned afterward, as historical accidents, not logical, but of some practical convenience, as purely contingent knowledge to be acquired practically as the occasion presented itself. She was sent to the grocer's to buy a bushel of apples, compared quarts, pecks, etc., together, and was never troubled with the mere memorization of tables.

After knowledge of the rainbow and the points of the compass, the third cosmic notion required was that of perspective. This was first learned by watching ships passing over the water near which the child was playing, and observing the diminution of size as the distance increased. This observation made a profound impression upon the child. It was, perhaps, the first time that she learned that appearances do not always correspond to the reality of things, and that simple perceptions must be constantly controlled by an effort of the reasoning intellect. A year later, thus, when the child was five years old, the subject of perspective was reviewed in a different connection. She tried to draw a cube, and was shown the device by which a slanting line is made to represent a retreat from the foreground to a distance. This new discovery proved as exciting as the first had been, and it was speedily tested on all the pictures hanging in the room. On the first occasion perspective had appeared like a great and astonishing fact of the external universe; on the second, like an immense achievement of the human intellect,

which had thus contrived to accomplish the apparently impossible—namely, the representation of solid objects on a flat surface. The lifting of such large horizons makes epochs in the history of the intellect! The study was not confined to the form or line, but extended to observation of the effect of light and shade—the darkness of a receding surface, the brightness of the nearest point of a spherical surface, etc. Then the child reproduced these effects in her own drawing.

At this time the child began the study of geographical maps as another method of emphasizing space-conceptions. For so young a child the dissecting map was much simpler than would have been the attempt to make actual surveys of familiar localities, as is sometimes recommended. These were deferred till a little later. By the aid of the dissecting map the child learned the outline of each of the United States, and their exact relations to each other, while still quite unable to read the names printed upon the models. In putting the map together, the compass was again brought into requisition, and the table on which the map was constructed turned until it faced the real north. The relative situation of places was always learned by reference to the compass, and not by arbitrary signs.

With so young a child it was impossible to associate much real information with these unknown states whose geometrical outlines she studied; therefore, every facility was offered to establish associa-

tions of fantasy, either with the shape of the pieces or with the names, associations which the child usually discovered for herself. Thus, she described Virginia as a kneeling camel; Texas, for some reason which I could not appreciate, as a man leaning on his pipe; Maine, as a dog's head; Tennessee, as a boy's sled, etc.

The study of the one dissecting map was pursued uninterruptedly for six months. In a few weeks the child had learned to identify and name each piece, either on her model or on other maps, and could put each in its place. Before she left the map she was able to bound any State with the models, or verbally; also to make strips of successive States, beginning at any point and running in any direction. With the entrance upon her second year, at the age of five and a half, the child began the study of maps from "Cornell's Geography." But in a very little while these were exchanged for a large relief-globe. From the time the child began the study of this globe it became difficult for me to understand how any other method could ever be employed. The picturesque effect of the distinctly outlined continents, visible at a considerable distance, separated by vast tracts of desolate ocean, in which, as the child remarked, "one could easily drown," the mutual relations of parts whose perception need never be disturbed, as is incessantly done when the pupil passes from map to map,—all these effects and impressions can be obtained from nothing else but from a globe

of adequate size and in relief. The child, when just six, began to draw maps from this globe. On a single very large piece of paper would be represented whatever outlines were discoverable at the maximum distance and at a certain aspect of the globe. The latter was then revolved somewhat, the child remaining at the same distance, and a new map outlined as before, and so on until the entire globe had been, in the major outlines, copied by the child. It was reserved for months of future study to fill in the details in proportion to their successive natural, not political, importance.

Four different spheres of thought were prepared for by this study. First, and most obviously, the foundations were laid for all knowledge of physical geography. This foundation was laid in vivid sense-impressions, and unalloyed with the singular mess of political, historical, and commercial details, with which even the best geographical text-books for children are filled, and which are quite irrelevant to the main issue. When the child could with her finger trace the watercourses all around the world, she received a large fundamental impression not easily forgotten. Incidentally in this tracing she learned the value of canals at the isthmuses of Suez and Panama. Secondly, a solid foundation was laid for history. The first map drawn was of Africa, on account of its simplicity of outline; but this involved the basin of the Mediterranean. The second map, passing eastward, took in the strongly accentuated outlines sur-

rounding the Indian Ocean, and indicated the Himalaya and the high table-lands of Northern India. In the future it was intended, with these same outlines under the eye, and the picture of them deeply graven on the brain, to indicate the descent of Aryan ancestors from these table-lands toward the Mediterranean basin—the germinal spot of our historical world; thence the further spread westward to the new hemisphere. The conception of an historical germinal spot was again prepared for in advance, by showing the child the cicatricule of a hen's egg, lying like the Mediterranean basin, on a globe. Thirdly, study of the systematized topography of the globe constituted the best initiation into the study of all topographical relations, including those involved in animal anatomy, and therefore this consideration was not among the least important. Fourthly, an important elementary philosophical training was obtained, as the child learned to analyze into their details the largest pictures offered by the globe, and to arrange these details into orders of successive degrees of generalization. Great care was taken that all pictures or outlines of the same magnitude, and hence visible at the same distance, should be studied at the same time, and not associated with less conspicuous details that required more minute attention. This rule of following successive degrees of generalization in geographical analysis is most imperfectly observed in text-books. It imposes itself in study of the relief-globe.

II.

AN EXPERIMENT IN PRIMARY EDUCATION.

(*Continued.*)

Only one attempt was made during this year to teach the child the meaning of words. It was done through a simple generalization which had become indispensable in the study of geometry, when she passed from plane to solid figures. By means of wooden models she learned, in addition to the cube, the sphere, ovoid, oblate, cylinder, prism, tetrahedron, octahedron, and dodecahedron. She then was led to make parallel lines of plane and solid figures with a corresponding number of sides or angles; then to abstract the Greek numerals *tri*, *tetra*, *penta*, *hexa*, etc., found to belong to both columns, and set this in the centre, with the syllable *gon* on one side and *hedron* on the other. An hour was required to complete the setting out of these figures and arranging these titles with movable letters, which for the first time the child learned to use for spelling. The exercise was, of course, repeated again and again, until every step was perfectly familiar. From the beginning the child had no difficulty in connecting the plane and solid figures, nor in learning the numerals appropriate to each. The new effort at abstraction and classification was at first somewhat hard, but

soon became easy. The facility with which the impression of forms may be made upon a child's mind, when this is as yet uncrowded by notions on the other qualities of objects, was shown by a little incident at this period. A few weeks after having made her first acquaintance with the oblate, she saw at dinner for the first time some small stewed onions. "Oh!" she exclaimed, "they have brought us some oblates for dinner." Another day, when she accidentally pulled the cord of a window-shade in a certain position, she observed that she had thus made "two scalene triangles." Looking at the ceiling above a lamp, she called to me to notice how the light made three "beautiful concentric circles."

One other study during the year was made upon the intrinsic meaning of words. In the course of some observations on plants the child had learned to recognize the ovary and ovule, and to herself dissect them out of a flower. When this had been done the analogy between the vegetable ovule and chicken-egg or ovum was easily pointed out, and the relation of the latter to the geometric ovoid. The four objects were then placed in a row on the table, the names of each spelled with movable letters, and then the common root *ov* described and taken out. The important and fundamental idea was thus grasped that there was an intrinsic meaning to at least some words, and also that objects associated by a common name, whose specific variations were of subordinate importance, must be classed together as

deeply related, notwithstanding superficial difference of aspect. But this idea, once distinctly enunciated and understood, was then set aside for a season. That the idea was understood, I tested in the following way: At table the child remarked that a particular potato was "shaped like an egg." "What shall we then call it?" I asked. "An ovoid," was the reply. "Very good. Do you know what I thought you might call it?" "An ovum," she answered, with an air of mischievous triumph. "And why did you not?" "Because it is not an egg, but only shaped like an egg." I tempted the child with the suggestion that she should tease the waiter by asking him to bring us some ovules instead of eggs; but the instinctive modesty of childhood recoiled from the pedantic proposition.

The necessity for precision in the use of terms, thus initiation into scientific terminology, was enforced incidentally on another occasion. A playfellow, much older than the child, picked up a piece of mica and called it isinglass. This conventional inaccuracy I strongly rebuked, and, procuring a piece of real isinglass, led the child to note its difference, and to condemn in private and without malice the slovenly language of her presumably untaught comrade. Now, the child had a doll called Rosa, and was in the habit of illustrating any absurdity by pretending that Rosa was guilty of it. Some time after the conversation on the isinglass she was watching a stream of water falling into the sunlight from a hose. She

exclaimed: "See the beautiful silver water coming from the old gray hose. Rosa would have called that mica!"

When the box of wooden geometric models was thoroughly mastered, after about six months' study, I procured for the child a set of models of crystals, such as are used for studying mineralogy. About half of these proved too complex for study, but the child easily learned to recognize and distinguish twenty-six, partly simple, partly compound forms. As each face of the crystal showed some plane figure which she had already learned, and as she was also familiar with the Greek numerals from three to twelve, it was generally easy for the child to devise the name of the crystal, even when apparently so repelling as a scalenhedron, rhombic dodecahedron, right rhombic pyramid, etc. It was interesting to notice her capacity to discern the general outline of a crystal and thus its generic features, and afterward to distinguish the secondary divisions of its sides, or the specific characters; thus in a four-faced cube, a three- or six-faced tetrahedron, a three-faced octahedron, etc. The forms in the four systems of crystallization were learned by repeated handling of the models, until the child's perceptions had become saturated with them, and she could, for instance, discover for herself four-faced cubes in the curved molding on staircases. Then, at the beginning of the second year, the crystals began to be copied in clay, and opportunity then afforded for studying their

axes, or the basis of their classification, by means of long pins thrust through the soft model in appropriate direction.

Arithmetic, the second science in Dr. Hill's category, was begun several months after the first studies of form and outline. Instead of the beans so frequently recommended, the child used sticks of different sizes and colors. For two or three months she studied such numbers as seem almost to form natural complex entities, and hence have often been sacred numbers, thus: four, nine, ten, twelve, twenty-four, thirty-six. The child was exercised in dividing these up into symmetrical groups, whose resemblances she was trained to tell at a glance by the eye before enumeration. Thus she learned to form groups of threes, fours, and sixes, and to unite them in as many fantastic combinations as could be invented. The object was to effect the transition from the perception of form to the conception of number by a series of visual impressions as vivid as possible. The breaking up of a whole into parts really precedes in facility the additioning of parts into a whole, for the reason that the power of destruction in a child obviously precedes the power of construction. Froebel's fifth gift of cubical blocks has its first application on this fact, since the entire mass forming a cube may be broken up into twenty-seven smaller cubes. When we reached the number twenty-seven, I told the child it was the smallest cube that existed. But she having a year previously,

when only four years old, learned to handle these same cubes, corrected my error, and demonstrated triumphantly that eight blocks would make a still smaller cube. The incident shows the tenacity of ideas once implanted in the right way and at the right time.

It is much more difficult to teach a child to subtract than to add, a fact upon which Warren Colburn sagaciously comments. In the discussion of practical problems a hitch often occurs in the child's mind which may be quite unsuspected by the teacher. Thus, if Henry and Arthur go to buy a ball which costs sixteen cents, and one boy had six cents and the other seven, I found the child unable to solve the problem as to how many more cents were needed, because, as she said, she could not take thirteen from sixteen, since the very trouble was that the boys did not have sixteen cents. It was necessary to use sticks, and with the distinct formal agreement that those of one color should be known to represent an imaginary number, those of another color the number of actual things manipulated. But what a stride for a young child's mind to make, into a sphere neither real nor imaginary, but where the existent and the non-existent are indissolubly associated in an ordinary practical affair of every-day life!

From the beginning the decimal system imposed itself spontaneously upon the child's mind, on account of the facility of visibly recognizing groups of five and ten sticks, and of verbally recognizing

their successive additions. In this way the multiplication table—the famous despair of little Marjorie Fleming—was mastered with great ease by this far less gifted child. Every one remembers the fierce vehemence of Pet Marjorie's protest, "But 7 times 9 is devilish, and what Nature itself can't endure!" It is so, if presented as an isolated fact. The child I taught, however, discovered of herself that the successive addition of tens was as easy as that of ones. After that, when she came to add (or multiply by) nines, she would say, "first add ten," then say, "and nine was one less." If it were eight, it was two less, etc. After a fortnight of these exercises, she was asked one day out of study-hours what was the sum of 14 and 19, and answered immediately "33." Upon being asked to explain the process, she said, "10 and 19 makes 29, then I must add 4 more, and 1 and 29 are 30, and 3 more are 33." When three decimals were reached, a somewhat laborious exercise was performed. Thus, to operate with 138, the number 100 was constructed out of ten packages of purple sticks, each package containing ten sticks. These packages were placed in a row; underneath was a second row, containing, to represent the number 30, three packages of yellow sticks, each containing ten; finally, a third row of eight units was made with green sticks in a single series. In this exercise the sticks were all of the same size; in another, later, a hundred was represented by a single long stick, usually purple, a ten

by a yellow stick next in size, a unit by a stick still smaller and green. Thus the original and clumsier representation was condensed by the substitution of an expressive sign for the literal numbers, and as soon as the sticks became used as signs, and not as the objects really to be counted, the mutual relation of their respective sizes also ceased to be literally exact, and became merely schematic. Thus was gradually managed a transition to the use of pure written signs or symbols. The transition initiated and enlarged the condensation of Roman into Arabic numerals. Knowledge of the process of subtraction, especially in three or more decimals, was essentially facilitated by this device with sticks, and the terrible difficulty of borrowing ten quite overcome. Thus, if the number 288 were to be taken from 362, the larger number would be represented by three long purple sticks, six shorter yellow sticks, and two green sticks, the shortest of all. These colors were always selected because harmonizing so well with each other. Then similarly the 288 was represented by two purple, eight yellow, and eight green sticks. It was easily recognized by the child, that one of the yellow sticks could be removed from the ten sections of the 362, and ten green sticks substituted, bringing the entire number of units up to twelve, from which the eight of the lower figures could be taken. It was also obvious that, when one yellow stick had been taken away, only seven remained. There was no need, therefore, to employ

the usual confusing statement that a ten must be borrowed from the upper figures, and later restored to a different place in the lower.

The study of abstract numbers, with Colburn's arithmetic, was begun when the child was five and a half years. At the end of a year she had thoroughly mastered the first four rules, including both "short" and "long" division, and was considerably advanced in the study of fractions, proper and improper.

The last study entered upon during this year was that of natural objects, and, for obvious reasons, plants were chosen for this purpose. I suppose that most persons seriously interested in education are acquainted with Miss Youman's admirable little "First Lessons in Botany," and the plea she makes for this science as a typical means of training the observing powers of children. According to her plan, the first object studied is the leaf—and the pupil is taught at once, not only to draw the leaf, but to fill out a schedule of description of it. Much may be said in favor of this method, which proceeds from the simple to the complex form; but it is by no means the only possible method; the writing part of the scheme is, moreover, impossible for a child who has not yet learned how to write. There is another method, which consists in seizing at once upon the most striking aspect of the subject, and which shall make the most vivid impression upon the imagination. For this purpose the leaf is the least useful, the flower the most so. The earliest botanical classifica-

tions are based upon the corolla, and, in accordance with a principle already enunciated, a child may often best approach a science through the series of ideas that attended its genesis. The conditions are different for an adult, who requires to get the latest results; the child's mind is always remote from these, but often singularly near to the conceptions entertained by the first observers. Again, it is unnatural to enter upon the beautiful world of plants by the study of forms and outlines—which is much better pursued when abstracted from all other circumstances, as in models of pure mathematical figures. But with plants comes a new idea—that of life, of change, of evolution. It is fitting that this tremendous idea make a profound impression on the child's mind; and this impression may be best secured by watching the continuous growth of a plant from the seed. The study of life is a study of events, of dynamics, of catastrophies. The earliest observation perceives the extraordinary influence of the surrounding medium upon the destinies of the living organism. It is not difficult to surround these destinies with such a halo of imagination as shall impress on the mind a sense of the mystery, sanctity—I may add, the necessary calamities—of life, before it has become absorbed in the consideration of living personalities.

I trust it will not seem a piece of bathos when I add that I initiated the pursuit of these objects by making the child watch the growth of seven beans on a saucer of cotton-wool. A specimen bean was

first dissected, and its principal parts named—the cotyledons, the embryo with its radicle and plumula, the episperm. The daily reference to these terms speedily rendered the child quite familiar with them. To seven other beans were given appropriate names, as of a band of brothers, and they were then planted on cotton-wool by the child. A daily journal of events was opened, in which I wrote each day or two, at the child's dictation. As she had learned the Arabic numerals, she inserted these herself in the protocol whenever necessary. The entire history of each bean was thus written out, and the successive steps of its development, from the thrilling moment when the radicle first peeped out, to the time when, after transplantation to a flower-pot, the plumula had developed to a long trailing vine. The rate of growth of this vine was measured day by day exactly, with a rule, the number of leaves counted, etc. But the mathematical considerations were here subordinated to a larger idea, that of the succession of events. Some of the beans moulded early in their career, and the relations of this catastrophe to the accidental differences of position, moisture, etc., were carefully studied. On one occasion the child dictated to me the following entry for the journal: "The episperm, on the under surface of Tertius, is all black, and has split, leaving a space the shape of an equilateral triangle, with the apex pointing to the convex edge of the cotyledons." In the summer, when flowers could be obtained from the woods in

abundance, the child made collections of ovaries and ovules, and was never tired of finding the latter asleep in their beds in so many differently shaped houses. At this time the static considerations were allowed to predominate, and the child rather forgot the function of the embryo seeds—so much so that, upon seeing some small pieces of ice lying in half a musk-melon, she said that these were like the ovules in an ovary. At the beginning of the second year, the study of plant-growth was resumed with seven hyacinths, that received appropriate names, as seven sisters. The first lessons in written expression coincided with the beginning of this new study; for now the child was allowed to write the plant-journal herself. The exercise was complex. The child first examined the hyacinths, and noted whether any thing had transpired since the last observation. She then framed a spoken sentence, in which such an event was accurately described. She then dictated the writing of this sentence as a whole, which she was afterward to copy. During this dictation, some knowledge of spelling was incidentally acquired; for the child was led to spell by sound, and without reference to silent letters. The words she had not yet seen. Finally, when fairly at work at the writing, the meaning of the sentence was temporarily ignored, and attention closely concentrated upon the forms of the letters, and no mercy shown to inaccurate imitation of them. Thus, one day she entered the observation that Blanche, in a blue glass, had

grown much more vigorously than Aura, in a dark one; and a blue glass was given to the less favored sister, in the hope that she would improve. She noted that the tips of the white roots were gray and conoid in shape (making the observation herself independently), and was allowed to demonstrate the function of these tips by cutting one off and seeing the growth of that root arrested. On another day, she first discovered, then described, then wrote down, that the first broad leaves of Blanche had split open, showing two others at right angles to them. This was her first perception of this remarkable law of phyllotaxy, and she herself illustrated it by making two loops with the thumb and finger of each hand, and making them intersect each other. The previous acquisition of mathematical conception was constantly shown to facilitate and render precise her observations of complex objects.

It was rather as a concession to a prevailing prejudice that at this time the child was taught to read. This study, usually made of the most importance, was held for this child to be quite subordinate and easy, and little stress laid upon it. The child was allowed to follow her own inclination, to divine the subject of the chapter from the picture at the head of it, and, to a considerable extent, the words in each sentence from the context; when the wrong word was thus suggested, she was obliged to spell out the real word by sounds, always seeking first the central or predominant sound, and building up the word

around it, instead of enumerating the letters in order. Thus in the word *scratch* she took the letters *a t*, as the central nucleus, preceding the first by the sound of *r*, then of *c*, then of *s*; then, when the sound *scrat* was complete, adding that of *ch*. She was made to read as much and as rapidly as possible, relying upon constant repetition and association of ideas to secure familiarity. Thus unconsciously the conception was continued, that written as well as spoken language was an outgrowth of thought, before the attempt was made to study it as an object of thought. This method is like that of learning to walk before studying the laws of Weber on locomotion.

This method may seem slovenly, but, after all, it is both the natural and scientific method of studying an unknown tongue, which must be deciphered by the context. How else did Champollion read the Rosetta stone, or Eliot find a written language for his Indian Bible? Throughout this period the task of reading was treated as something so easy as to be insignificant, and was so regarded by the child herself.[1] The main intellectual work of the day's lessons (whose duration was never more than an hour and a half) was concentrated upon the arithmetic, map-drawing, analysis of flowers, and the geometrical studies, that she now pursued by the help of Hill's "First Lessons," and Spencer's "In-

[1] What is easy, when taken instinctively, may be incredibly difficult when itself becomes the object of thought and study.

ventional Geometry." She studied angles, vertical and adjacent, the relations of angles and circles, and the measurement of the former by the latter. Exercises in these were practised daily with compass and ruler; and, when lines drawn with the pencil failed to give a large enough visual impression, they were designed with colored sticks. This enlargement of the material illustration never failed to clear up any obscurities. At the time these notes cease, the child was six and a half years old.

I have tried to make clear in these few notes the outlines of a (single) experiment, which seems to me to show that the mental education of even a very young child may be imbued with the scientific methods and even ideas which should furnish suitable preparation for advanced scientific studies. It cannot be a matter of indifference that such habits of mind are acquired from the beginning, or only after much previous faulty training. What comes first will always remain the most important, will always dominate the rest. Experience in the medical education of women has repeatedly brought home to me the difficulty of teaching such an art as medicine to persons who come to it through the prevailing systems of school discipline, especially those which are applied to girls. Experience with one little girl at least, convinces me that the aptitude for vivid and accurate perception, and for scientific method in ideas, often exists where unsuspected, and only demanding proper cultivation.

As an illustration of the method described in the text, when carried into more complete studies, I insert an exercise written by the child when six and a quarter years old. It is a description of a wild Iris, which she analyzed herself on successive days, writing down the results from *memory* on the next day. She was never told any thing, but obliged to discover for herself each fact, to compose the sentence describing it, and to spell by ear the words of the sentence without copy. She was allowed to insert in her description whatever fancies occurred to her. The headings and order of evolution of the subject were alone dictated. With nearly all the technical terms she was, however, already familiar ; two only were told—"perianth," as opposed to corolla, and "blade." Before analyzing the Iris she was obliged to take a long walk to the woods for it, and first to draw a map showing the way, and by means of the compass. Two intersecting lines from sight-objects were dictated by me, and the fact learned by this and another previous experiment which had failed, that to locate an object in space at least two lines are required. The final description, whose writing occupied two or three weeks, was as follows :

The Rainbow Family.—(This name was given as a literal translation of *Iridaceæ*, and as a return in a spiral to the first natural object studied eighteen months before, the rainbow. The way was also prepared for the future historical study of the myth of Iris.)

Iris Tricolor.—(The numeral was already familiar.)

Perianth = 6 *Petals.* (The algebraic signs and numbers were used to indicate that in a scientific document, not a flowing style, but the fewest words and most concise expressions were required.)

These stand on top of a long tube in which the style is locked in. There are two kinds of petals : 1. Three which are the biggest, and have three colors. There are two parts to each—the upper broad part called the blade, and the lower long narrow part. (The term "blade" was here taught for the first time.) The blade is first purple ; in the middle is a gold

stripe which runs into the narrow part. (At this point, the child drew and painted from memory, on the margin of her protocol, a picture of the petal.) Between the purple and gold the blade is white. These petals curve outward and downward, so that the gold stripe comes on top. The bees see it and come for the pollen. (First introduction of a Darwinian law.) 2. Three petals, which are entirely purple, are vertical, smaller, and stand between the others. (The child made another drawing by opening the flower on the page and tracing its outlines.) It is as if six girls were standing in a circle (here was introduced a botanical outline of the whorl, instinctively devised by the child, the circle being drawn accurately with compasses). Every other one leans back and stretches her arms out horizontally, as if to show her gold bracelet. The three others lean forward, and hold their arms up above their heads. (Prolonged contemplation of this lovely group tended to evoke such instinctive æsthetic conceptions as are at the basis of many pieces of statuary, notably Thorwaldsen's Graces.) The gold stripe is like the orange feathers on the head of the bee-martin. The bees think it is a flower, and come and settle on the bird's head ; then he catches them. (This illustration was suggested by the child, shortly after having seen such a bird which had been shot. She thus learned to step from one section of natural history to another, and also to seek analogies of organs in their functions.) Mamma says (here knowledge by testimony is distinguished from that obtained by personal observation, which has not yet reached so far) that all flowers that want the bees to visit them have bright colors. This is like ladies who want the gentlemen to visit them, and then put on their finest clothes.

The Great Mistake.—We thought there were three more petals in the middle of the corolla. These were smaller than the others, and divided at the top like a funny M. (The child then made a drawing in illustration.) Each stands inside a gold-striped petal, and has a groove on the outer side like a bath-tub. In this a princess is bathing. She is a stamen, with

a long, whitish anther like a veil over her head. So there were three stamens inserted with the petals.

How we found out the Truth.—(This process is introduced with some solemnity, as befits its importance.) 1. We looked to see how the pollen got on the stigma. (Introduction to the biological method of studying structure in association with function.) 2. We noticed that the pollen could slip down the groove into the tube leading to the ovary. 3. We saw that the petal-like pieces were fastened together in the middle of the perianth, making a solid white cylinder which passed into the green tube. (Another drawing from memory illustrated this.) 4. It was plain that the white cylinder was the style, because it went to the ovary. 5. Then mamma said (recognition of authority and testimony again) that the petal-like pieces were the stigma, immensely big. (The incident showed the function of the reason in unravelling the deceptions imposed by the senses and the superficial aspect of things.)

Ovary—at the bottom of the tube (ovary inferior)—has three lodges and a great many ovules.

(Thus the botanical analysis was rigidly accurate and complete. But, instead of being a dry schedule, it comprised a mass of vivid, glowing impressions destined to remain forever as a typical group of ideas in the child's mind. The prolonged, patient, sympathetic study of the individual preceded the abstract study of a class of flowers. In the future it was intended that the child should construct her own classes from among the botanical individuals she should really learn to know.)

III.

THE FLOWER OR THE LEAF.

> " Quod she agen, ' But to whom do ye owe
> Your service? and which wolle ye honour,
> Tel me I pray, this yere, the Leaf or the Flower?' "
> —CHAUCER, " The Flower and the Leaf."

The comments made by Miss Youmans,[1] upon a single remark in my article on "Primary Education," show how much can be unfolded out of an apparently limited subject, when all its bearings are thoroughly discussed. Already this discussion trenches upon several philosophical principles which involve much more than the apparently trivial question whether children should begin the study of botany by the flower or the leaf. An inquiry into these principles may therefore not be uninteresting.

Miss Youmans lays down certain propositions, with some of which I do in reality agree, while with others I am in decided disagreement, for reasons I will take the liberty of here setting forth. Thus:

1. Children should study the external characters of plants before attempting to study their life-processes or physiology.

2. Children cannot be suitably impressed with

[1] *Popular Science Monthly*, October, 1885.

such "tremendous ideas as evolution," and therefore it is useless to signalize these to them.

3. Children should not be detained to draw the leaves or other natural objects they study, because of "the delay" thus entailed, and because "they could not draw one in a hundred of the specimens with which it is necessary that they become familiar."

4. The modern systems of botanical classification are based on the sum total of the characters of the plant, and not on the corolla. It is therefore unphilosophical to study the flower containing the corolla first, merely because it is more showy. The sensuous pleasure derived from its contemplation is superficial as compared with the deeper intellectual pleasure of tracing the scientific relations of the leaf.

5. Finally, it is an axiom that cannot be disputed, that mental effort should advance from the simple subject to the more complex. The leaf is much simpler than the flower, and is therefore much better suited for beginning the study of botany.

To consider these propositions in order: 1 and 2. In regard to the first I am substantially in entire agreement with Miss Youmans, as indeed is shown by the examples given in the "Experiment." No attempt was made to really study the physiology of plants; while the external and obvious characters of the most conspicuous portions, the parts, namely, of the flower, were studied, or rather submitted to a prolonged contemplation. Only, upon first crossing the threshold of this new world, the most character-

istic facts which distinguished it were pointed out in a manner designed to make as profound an impression as possible upon the imagination. These are the facts of life and growth and death, the germination of the seed, the influence of surrounding media, the circumstance that the plant offers a constant succession of changing phenomena, and thus was an entirely different object from a stone, or a mathematical figure, or a rainbow. Now, while it is perfectly true that the term " evolution " and the vast series of ideas and masses of facts suggested by it cannot be rendered comprehensible to a child, and that it would be the grossest pedantry to even mention it to him, yet the great fact of growth and incessant change in living organisms is perfectly appreciable through impressions made on his senses, and is well fitted to arouse in him a lively interest and curiosity. The fact of life—the essential nature of life as a series of incessant changes—is perhaps the most fundamental fact with which the mind will ever become acquainted. It is also among the most primitive and earliest encountered; the mode of impression it makes upon the mind permanently stamps all the thoughts and systems of thought the mind ever entertains. For, whence spring all religions, and cosmogonies, and even ethical systems, but from the primitive thoughts held upon life and death? How many immoralities depend upon false estimates of life, of its nature, its values! How many erroneous theories of life might be corrected

by the early habit of direct, unbiased observation of living things! In the building of a brain, the earliest ideas always remain the most powerful, because upon them the entire mental structure is destined to repose; or, since the mind is a living organism, it were better to compare its primitive ideas, not to the foundation-stones of a house, but to the central medullary rings of a tree. What is on the surface while the plant is young soon becomes central by the successive superposition of new impressions, the new circles being constantly intersected by rays prolonged from the central pith. The selection of the earliest ideas and impressions is therefore of the highest importance; they should be not only negatively good, that is, innocent, but, when possible, really powerful, that is, brought from the depths of things, and able to sustain all the future life of the mind possessing them. And, since direct perception of facts must precede reasoning upon the inferences which may be drawn from them, it is not only legitimate, but important to impress the imagination with typical and fundamental facts, long before these can be reasoned upon, or their laws really understood. This is my lengthy reason for the simple experiment of studying the growth of beans on a saucer of cotton-wool—experiment designed not to teach physiology, but to make an early revelation of life.

In this connection, however, is worth noting a special reason for preferring the flower to the leaf for early study. It is agreed that the functions of

living organisms are too difficult for such study; nevertheless, it is desirable to *indicate* functions when possible, because the fact of function is one eminently characteristic of living things. Now, the function of the leaf is respiration, which cannot possibly be made intelligible to the child. It involves chemical relations, which are the latest appreciable, and cannot be exhibited except by means of experiments, for which the young child is quite unprepared. The absence of the visible phenomena of animal respiration, moreover,—that is, of the exhalation of the breath and movements of the thorax,—render an attempt to identify the function in plants and animals confusing and apparently contradictory.

On the other hand, the function of the flower—reproduction—can be rendered perfectly intelligible to the child, when he is told that the pollen feeds the ovules, which then visibly grow into seeds, while the ovary ripens to fruit. This statement seems to the child in accordance with his own most urgent personal necessities, and in the common facts of feeding and growth he finds himself linked with other organisms in Nature. It is quite congenial to the normal fetichism of a young child's mind to regard plants as animals; and legends of dryads are as natural to him as to the infancy of the human race.

But the assimilation of animals to plants through the molecular processes of nutrition common to both (though perhaps unconsciously foreshadowed in the

story of Narcissus) was not for mankind distinctly formulated until the time of Bichat; and, for the individual intelligence, its comprehension must be deferred until nearly to adolescence.

3. I must plead guilty to an inaccuracy when, quoting from memory, I said that Miss Youmans recommended her pupils to *draw* the leaves that they studied. But I fell into the error all the more readily, because such a direction entirely commended itself to my own judgment. Nor can I agree at all with the reasons which Miss Youmans now advances in opposition to this method. If the aim at the time be not to learn botany, but "to cultivate the observing powers of children," what danger is there in a "delay" which permits the object to become more deeply graven on the child's mind? Why is it so "necessary to become familiar with hundreds of specimens" in a given time? Why not rather with a few, a very few striking and typical forms, around which subsequent knowledge can group itself? The comparison of a multitude of objects in order to abstract their common characters, and thus obtain the generic or class conception, is suited to the scientific, but not to the pre-scientific stage of progress. It does not, therefore, belong to the fruitful moment of first attraction to an object, which, for the adult mind, precedes scientific discovery, and contains the hidden forces which lead to this. Still less does it belong to the first mental efforts of childhood. Early childhood is a period for the differentia-

tion of the details of a universe, which, to the earliest perceptions, appears to consist entirely of homogeneous masses of light and shade. In the first efforts of the mind these masses are broken up and separated from one another, and portions reintegrated into actual individuals. Thus the moon is separated from the window-pane, the child's limbs are integrated into a body, which at last is positively known to be different from other moving forms, etc. It is in accordance with this spontaneous and, indeed, inevitable mode of development of perception, that the first educated efforts of perception should be directed toward the more intense individualization of objects, and not to their classification; toward the thorough appreciation of specific differences, rather than to that of generic resemblances. Hence, a second reason for beginning the study of botany—say, rather, the observation of life—with the flower, although more complex, and not with the simpler leaf. It is because the individual differences of the flower are so much more striking, and—as the poets show us—the flower is so much more readily individualized and personified.[1]

The period of development with which my "Experiment" was concerned may be called the prescientific stage of mental existence. It is that during which the mind may be busily occupied in collecting

[1] Trees, however, seem to have occasionally shared the poetic individualization. There is Emerson's "Pine-Tree," and "The Pine and the Palm" of Heine, not to speak of "The Fir-Tree" of Hans Andersen; and who could forget "The Talking Oak"?

the data for science, but cannot itself wield scientific methods. Its efforts should be directed in accordance with scientific principles of psychology, and the knowledge acquired arranged in such orderly sequence that, when the mind is ripe for them, scientific relations will be readily perceived and understood. But discussion of such relations seems to me entirely premature for the age here considered, and, indeed, for a much later period.

Scientific observation is observation of the relations between things. But, before any attempt be made to study these relations, the things themselves should be firmly and clearly apprehended. The different degree of grasp possessed by different minds depends largely upon differences in the degree of vividness and fervor with which they are impressed by individual objects, which leave so many persons in the most limp indifference, while exciting in others an absorbing and even passionate interest. When the individual impressions are so clear, distinct, characteristic, and interesting as to be quite unforgettable, they soon force upon the mind, after prolonged contemplation of them, suggestions of their multiple relations, and the knowledge which was at first simply picturesque becomes, sooner or later, scientific. The mental power which arrives at this is largely innate, and beyond the capacity of any education to bestow. But if any educational method can increase and develop it, it is that which most nearly imitates the spontaneous habits of fertile

and original minds, apart from all systematic intention.

Three characters are conspicuous in the observation exercised by this class of minds: it is single, it is imaginative, and it is indefinitely prolonged. It is single—that is to say, the mind which is powerfully attracted to any object—and none ever discovers any thing in any object to which it is not powerfully attracted—is in no haste to detach itself and pass on to any thing new; on the contrary, it lingers and hates to go, and delays, and returns again and again to catch still another glimpse of what has been so delightful. To say that an object is suggestive is to say that it constantly opens up new trains of thought, and, so long as this is the case, the mind cannot bear to abandon it. It is on this account that the contemplation is indefinitely prolonged, and irregularly so, according to no fixed rule or extrinsic necessity, not even that of mastering a certain quotum of information, but varies in accordance with the infinitely varied accidents of the mental intercourse. Finally, to be fruitful, this intercourse must be imaginative. First, in the lowest and most literal sense of the term, since the mind cannot directly handle the sense-perception of the object, but only the mental image of the object, revived and remembered. But, in addition, to detect all its hidden meanings, properties, and possible aspects, many functions of the imagination must be brought into play, and none are useless. Fertility of fancy, rich

association of ideas, are as important in collecting the premises for scientific argument as is the argument itself in the discovery of truth.[1]

During the pre-scientific period, therefore, either in the history of the race, the development of the individual, or the evolution of any single idea in an inquiring mind, the cardinal necessity is that of filling the mind with an abundance of distinct concepts and visual images of real concrete existences. Any prolonged attempt to compare, generalize, or reason about these should be deferred, under penalty of substituting a mere verbal imitation of reasoning for a real effort of the mind. A certain amount of reasoning and comparison will, of course, arise incidentally, but it must be kept subordinate to the main purpose. The soil must be enriched before it is plowed. Ideas must be clustered into dense and rich groups, individualities magnified and intensified, as, to keep to our subject, the flowers which are classified by the botanist may be individually magnified into almost conscious beings by the poet.

> "A nun demure of lowly port,
> Or sprightly maiden of Love's court,
> In thy simplicity the sport
>   Of all temptations;
> A queen in crown of rubies drest,
> A starveling in a scanty vest,
> Are all, as seems to suit thee best,
>   Thy appellations."
>
> —WORDSWORTH, "To a Daisy."

[1] In these respects the mental history of the celebrated Faraday offers a mine of interesting facts and illustrations.

"While the patient primrose sits
Like a beggar in the cold."—Wordsworth.

"Here are sweet-peas on tiptoe for a flight
With wings of gentle flush o'er delicate white,
And taper fingers catching at all things
To bind them all about with tiny rings."—Keats.

"Bloomy grapes, laughing from green attire."—Ibid.

"And the rose like a nymph to the bath addrest—
And the hyacinth's purple and white and blue,
Which flung from its bells a sweet peal anew
Of music, so delicate, soft, and intense,
It was felt like an odor within the sense."—Shelley.

". . . daffodils,
That come before the swallow dares, and take
The winds of March with beauty; violets dim,
But sweeter than the lids of Juno's eyes
Or Cytherea's breath."—"Winter's Tale."

"Continuous as the stars that shine
And twinkle in the milky way; . . .
Ten thousand saw I at a glance
Tossing their heads in sprightly dance."
—Wordsworth, "The Daffodils."

"Daisies, those pearled arcturi of the earth,
The constellated flower that never sets."—Shelley.

"The gold-eyed kingcups fine,
The frail bluebell peereth over
Rare broidery of the purple clover."—Tennyson.

"Open afresh your round of starry folds,
Ye ardent marigolds!"—KEATS.

"Death in the wood—
In the death-pale lips apart,
Death, in a whiteness that curdles the blood,
Now black to the very heart.
. . . .
To show that life by the spirit comes,
She gave us a soulless flower."
—ELAINE GOODALE, "The Indian Pipe."

Hence the suitableness of flowers for making large, forcible, indelible impressions on the imagination and the memory, and for storing the mind at the outset with the most vivid and beautiful conceptions of Nature.

The leaf offers, indeed, a variety of beautiful forms and outlines, which are not, however, either so numerous or so conspicuous as those displayed by the various organs of the flower. Leaves contrast less conspicuously with one another; their sensible differences are much less striking, and the eye of the child is not sufficiently trained to adequately appreciate the subtle differences of color which really exist. To him leaves can scarcely fail to present the vast monotony of green which the primitive vegetation of the earth is said to have exhibited before variegated corollas appeared. It is certainly desirable to repeat for the individual mind the experience of the race; but is it necessary for that to go back to the ages which antedated even the prehistoric man?

In a word, the differences of flowers resemble the "legend writ in large letters" which Plato advised should be first studied; the differences of leaves make the same legend repeated in the "small letters," and therefore more difficult to decipher.[1]

4. Miss Youmans's reason derived from botanical systems of classification I scarcely understand. It is very true that classification by the corolla is abandoned, and indeed never could have been carried very far. But the natural system, which sums up the total characters of the plant, certainly derives a much larger number of its data from the flower than from any other part of the plant. The great function of the plant is reproduction, and around the organs of reproduction contained in the flower centre all its peculiarities. The mutual relations of stamens and pistils have been found inadequate for classification; but the extension of the class lines has still been chiefly in the direction of other parts of the flower, especially the fruit, ovule, and embryo.

Toward the flower converge all the forces of the plant; it is the culmination, the perfection of the entire vegetable organism. It should therefore be contemplated first, because, as it seems to me, it is eminently desirable that the child should, whenever possible, see the principal thing first; since whatever comes first is always liable to remain for him the most important. The habit of ranking things in the order of their real relative importance is certainly a

[1] "Republic," book ii., 368 (Jowett's translation).

most valuable habit to cultivate, both morally and intellectually. As has already been pointed out, the mind in its growth closely resembles that of a tree; for it, primary facts constantly tend to become central facts, and due organic proportions are only maintained between ideas when the principal, by being placed first, is enabled to become really central, a vitalized centre of fitly organized knowledge. For all life develops from centres; and in Nature there are no single lines.

5. Miss Youmans's final proposition, that progress must always be made from the simple to the complex, is the one with which I do most decidedly disagree. The expression itself is ambiguous: for it may mean the transition from the easy to the difficult; or it may mean the study of elements as a preliminary to the study of the compounds into which they enter. In the latter meaning, the proposition cannot surely be applied to the leaf and the flower. Morphologically speaking, it is true that all the parts of the flower result from transformations of the leaf, but this fact is altogether too recondite for a child's appreciation. In no other sense can the leaf be said to enter into the flower as an element—to be a "simpler" part of it. No knowledge to be gained of the flower, other than these facts of embryology, pre-supposes or requires knowledge of the leaf. Study of the one can only be said to prepare for the other by the degree of mental discipline it affords. And the very question at issue is, What is

the best for mental discipline, the contemplation of objects with the fewer and less obvious characters, or of objects at once more conspicuous, and more abounding in interesting details? I have already stated the reasons which seem to me to justify the selection of the second method.

The first seems endorsed, and perhaps is intended to be so, by the Comtist classification of the sciences, and by the rather arbitrary attempt of its author to identify this with the actual order of their historic evolution. As regards their subject-matter, it would certainly be untrue to assert that this attracted the attention of mankind in the order of its (philosophically considered) simplicity.[1] At what appear to us to be the opening periods of Greek thought we find already co-existing the germs of all the six fundamental sciences, if we may assume that even chemistry was foreshadowed in the doctrines of the Four Elements. Such co-existence was inevitable, for the moment that the human mind was aroused enough to observe and theorize about any thing, its attention could not fail to be attracted in several different

[1] "While he [Comte] asserts that the rational order of the sciences, like the order of their historic development, 'is determined by the degree of simplicity, or, what comes to the same thing, of generality of their phenomena,' it might, contrariwise, be asserted that, commencing with the complex and the special, mankind have progressed step by step to a knowledge of greater simplicity and wider generality."—SPENCER, "The Genesis of Science."

Mr. Spencer goes on to quote a remark of Whewell's that "the reader has already repeatedly seen in the course of this history complex and derivative principles [read 'objects'] presenting themselves to men's minds before simple and elementary ones."

directions simultaneously. It noticed the form and number of objects, and founded the sciences of geometry and arithmetic. But it was quite unaware that these sciences deal with simpler elements than make up human organisms, and believed that physiology and medicine are far simpler subjects, and far less involved in sublime mysteries, than are mathematics. All subjects were studied, or at least speculated upon, in no other order than that of their apparent nearness to human interests and that of the obviousness of their phenomena.[1]

Exactly the same is true for every individual mind, whose perceptions are not regularly successive, but simultaneous, and are as liable to be attracted toward infinitely complex objects as toward the simplest details. It is true, as has been pointed out in the "Experiment," that a child's first perceptions are necessarily of form and color, and the ideas of form belong to mathematics. But color is a physical property of bodies, and therefore the subject of a science which is, according to the Comtist measure of simplicity, two degrees removed from mathematics. On the other hand, the property of number, although, like forms, mathematical, is not grasped till long after color and many other physical properties have been appreciated.

Other properties of bodies become known in direct

[1] "The broad distinction between the two orders of knowledge [the ordinary and the scientific] is not in their nature, but in their remoteness from perception."—SPENCER, *loc. cit.*

proportion to their obviousness, and to their accidental impact on the senses, or to their association with the personal experience of the child. These may be mathematical, physical, biological, or even social. The mind of the child, like that of the race, looks over the surface of all things at once; its progress is not from the simple toward the complex, but from the superficial and obvious toward the profound and hidden. The mutual aid rendered by sciences, when, to use Herbert Spencer's expression, they become *arts* to one another, is only required after the observation and registration of accessible facts are completed, and when analysis is required to bring to light new facts or to explain others. But the child's mind does not reach this stage, and it is either illusory or fatal to attempt to force it prematurely.

It is very interesting to notice, by study of the actual evolution of knowledge, what a large amount of knowledge was obtained simultaneously in each department by independent observation, and before the necessity for mutual help, other than that derived from elementary mathematics, had been perceived. During this period the advance was made in each science, not by deductions from some simpler science, but by observations and methods peculiar to itself. Thus, as already, stated, the germs of mathematics, physics, biology, and sociology, are all found co-existing at what seems to us the opening periods of Greek thought; nor was their degree of development at all proportioned to their degree of simplicity. If some

truths of geometry and arithmetic were really established, so, in spite of the obscurity surrounding biological laws, were many phenomena of living beings also observed. The pulse was known, if the circulation was not, and numerous are the clinical observations of Hippocrates which still hold good even in the scientific sphere of prognosis; and who could deny the permanent value of many of the ethical, political, and historical speculations of the ages of Plato, Thucydides, and Aristotle, even though, according to the Comtist doctrine, sociological speculations should have been valueless at this time, because entirely premature?[1]

The epoch of acquisition of facts, which must precede the discovery of their laws, often stretches over long periods of time—periods which interest us, because corresponding to the moment of education with which this discussion is concerned. The labors of the alchemists accumulated immense material on the composition of bodies and on their more recondite properties long before the scientific relations of chemistry could be established through the law of definite proportions. Physiology, the most complex of the physical sciences, has been most heterogeneous in

[1] "What has often led linguists to regard the elementary monosyllabism of the Chinese as the primitive condition of all languages is the tendency which leads us to consider simplicity as indicating a state of infancy, or, at least, as the sign of a high antiquity. But this is an error. The Chinese language, though monosyllabic, has served a highly developed civilization; on the other hand, the languages of the savages of America, of Central and Southern Africa, offer a surprising richness of grammatical forms."—Renan, "De l'Origine du Langage," p. 13 of preface.

the methods by which it has established its fundamental facts. The nature of respiration was, indeed, established by a chemist, from chemical data and from chemical experiments. But the nature of the circulation was partly inferred from anatomical facts —the presence of valves in veins,—partly demonstrated by vivisection, a method of investigation which could not possibly be suggested by any other science than physiology. Knowledge of physics has materially assisted the interpretation of blood-pressure, of the expansion of the lungs, and many other phenomena, first known by direct observation of them. But the demonstration of the functions of the nervous system has been made exclusively by means of physiological experiment and clinical observation. "Science," observes Renan, "in order to formulate her laws, is obliged to make abstractions and to *create* simple circumstances, such as Nature never presents."[1] This is done usually with the aid of a simpler science, or one of wider generality, whose mastery thus becomes indispensable to further progress. But, until the moment for analysis and experiment has arrived, observation of the complex object is not more, but rather less difficult than that of the simple one, because in it so many varieties of details offer themselves spontaneously to the attention that the mind is at once fully occupied so soon as it begins to carefully observe; whereas pure observation soon exhausts the details of a simple

[1] *Loc. cit.*, p. 59.

object or phenomenon, and no further progress can be made until after a profound analysis has plunged below the surface. Let any one compare the rate of progress in the discovery of new knowledge in mathematics, astronomy, and even physics, with that of its incessant registration in chemistry and in all the biological sciences,—registration often effected, moreover, by a relatively mediocre order of minds.

The child, like the race, begins at once with two sets of mental activities—sense-impressions, and speculations suggested by them and by emotional experience. Since complex objects are capable of making impressions on its senses, and of suggesting speculation, it is often both possible and profitable to study the external and perceptible characters of these objects, as well as those of simpler ones. The child, like the infant humanity, is incapable of profound analysis, and a premature habit of analysis is morally destructive.[1] It is this very incapacity which makes the complexity of objects a matter of indifference, since it is only by analysis that the difference between simple and complex objects can be recognized or felt. Whatever makes a large impression upon the senses is, other things being equal, easy of apprehension, even when not of *com*prehension. Whatever does not do so, whatever demands the intervention of abstract reasoning and inference,

[1] The effect of this is shown in the autobiography of John Stuart Mill, as the author himself points out in a striking chapter.

is difficult—often so difficult as to be really impossible—even though the child pretend and appear to understand.

And thus, to return to our starting-point, it is for all of these reasons that I have preferred to introduce the world of plants by the flower, with its marvelous variety in form and color, in port and expression and inflorescence, in contrivance of petal and stamen and pistil, and in manifold destiny of fruit. I would, undoubtedly, and in accordance with the principle already laid down of indicating many things on the mental horizon before the time should arrive for paying systematic attention to them, bring forward a few salient leaves as types: the needles of the pine, the rounded floating leaves of the water-lily, the truncated leaves of the tulip-tree, the five-fingered leaves of the maple, the pinnated leaves of the sumach, the asymmetrical leaves of the begonia, the woolly leaves of the mullein. But I should reserve the systematic study of "hundreds of specimens" to a much later period, and then enter upon it with all possible enthusiasm, and prepared to especially consider the numerous mathematical relations presented by these exquisite organic forms. Not only through study of their geometric outline, but in their multiple arithmetic combinations of insertion and section, may the pupil be led to the fruitful modern methods which involve the application of mathematics to the non-mathematical sciences.[1]

[1] See "Études comparées des Feuilles," par M. Fermond, 1864.

IV.

THE PLACE FOR THE STUDY OF LANGUAGE IN A CURRICULUM OF EDUCATION.

I.

The study of language has always occupied a conspicuous place in educational curricula. The Greeks, who counted all languages but their own barbarian, taught the grammar of their own as the basis of all education. The Roman children studied Greek as ours do French—less as an education than as a fashion. The first mediæval schools established grammar in the trivium, or most elementary course, and also in the quadrivium. The feeling has always prevailed in civilized communities, that as the mind was never seen to work without language, the study of language must lie at the basis of all mental training. We know now that much mental action precedes the use of words, and whenever we are logical to the laws of mental development, we train the mind to handle sense perceptions of external objects before we introduce the systematic study of language, even in reading and writing the mother tongue. Every one knows, however, that this change in the school curriculum is most recent.

The moment arrives at last when the study of lan-

guage must begin, even if nothing is learned but the native language of the child. This moment may to a certain extent be compared with that illustrious epoch in European history, when at the Renaissance of learning, classical Latin and Greek were rediscovered for the modern world. The extraordinary effect of this discovery may well serve to prove the importance of language to thought. With an imperfect and inadequate language, the nations of Northern Europe had remained in a narrow, cramped, and as we now often say, with perhaps considerable exaggeration, a barbarous existence. Restored to the noble speech of which they were the just inheritors, their compressed life rapidly expanded to its measure. The new vitalities aroused, soon in turn expanded the hidden potentialities of the antique tongues to all the flexible and varied needs of the modern life, and this life rapidly developed to a hitherto unknown degree of complexity. An immense number of thoughts seemed to have been impossible from the lack of fitting words. When these words were found—the buried treasure of by-gone ancestors,—the thoughts sprang to them as rider to the saddle; and with new ideas, life was regenerated.

Thus, although the material for the physical sciences existed in the same abundance then as now, these sciences failed to develop until after the Renaissance of classical learning. It seemed necessary that Scaliger and Erasmus, in the sixteenth century, should precede Gilbert and Harvey in the seven-

teenth, to render possible their discoveries of electricity and of the circulation of the blood. The solitary labors of Roger Bacon in the thirteenth century had flickered like a taper in a vast cavern of darkness, and then failed for lack of air. The human brain could not advance in analysis of the external world until it had been disciplined and developed in its internal activity by training in language.

But, at the present day, the educational value of the study of languages has begun to be seriously questioned. In a late number of the *Forum* Dr. Flint declares that as much mental discipline can be obtained from study of physics and chemistry as from study of languages, and that the knowledge thus gained is both more useful and more easily understood than the construction of Latin and Greek. He also observes that the range of subjects on which knowledge is desirable has greatly widened since the classical curricula were planned, and that it is impossible to do justice to all that is necessary to-day if we continue to fulfil all the demands which were made two hundred years ago. Similar remarks are repeated over and over again, and on all sides. These assertions touch, indeed, upon some truth, but they do not comprehend all of it, and they overlook much that is essential to the questions at issue. The problems to be considered are:

1. Does the study of language exercise any different effect upon mental development from the study of any other subject, and if so, what is it?

2. How does the effect of language study compare

with that of mathematics, of the physical sciences, of the moral and historical sciences?

3. If such special effect can be proved, at what age or epoch of education is it most appropriate and useful to seek for it?

4. Is there any difference between the effect on the brain of the classic and the modern languages?

5. If languages are to be taught, how is the necessary time to be secured for teaching other things most important to know and too often neglected?

6. What proportion should these relative branches of study bear to each other in a general, non-specialized curriculum?

7. What special devices or methods may be suggested to facilitate the accomplishment of the above-mentioned ends?

At the outset I would call attention to a fact which might seem self-evident, yet is generally overlooked in pedagogical discussions of the subject. This is, that the study of languages must be an extension, more or less complex, of the process of acquiring language—the highest physiological acquisition that distinguishes the human race from the lower animals. The method and educational results of such study are, therefore, primarily a physiological problem, and should be discussed by physiologists before they are handed over to pedagogues.

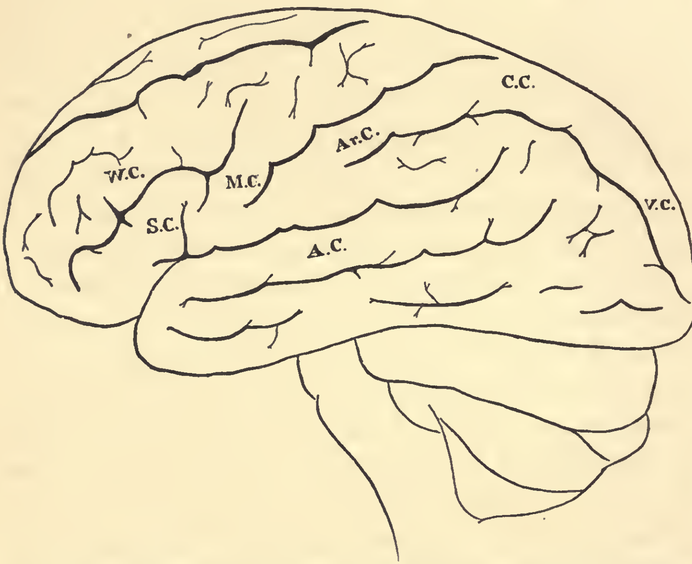
The genesis of speech is one of the most extraordinary and mysterious phenomena in the history of mankind. It has always justly excited the astonishment and speculations of philosophers.

It is most difficult to understand why any particular sound, or group of sounds, should have become significant of one object or idea rather than of any other. A purely physiological theory has tried to classify all words according to the parts of the articulating apparatus at which their fundamental sounds are formed, thus giving one intrinsic meaning to guttural sounds, another to labials, another to dentals, etc. But this theory cannot meet all the facts of the case. Prof. Max Mueller, who traces all words in the Indo-European languages back to 850 primary Sanscrit roots, is inclined to accept another physiological explanation of the genesis of the roots. This is the theory of Noiré. The latter has pointed out that whenever a number of people are engaged together in any muscular work, they have a tendency to utter aloud certain rhythmical sounds. "These are almost involuntary vibrations of the voice, corresponding to the more or less regular movements of the whole bodily frame." Noiré suggests that some special nerve element, or group of nerve elements, in the brain is then thrown into vibration coincidently with the external muscular movement; and this associated nerve vibration being propagated to the part of the brain which innervates the organs of articulation, the latter are excited to so modulate the simultaneously developed current of air in expiration, that a definite sound, one of the primitive root sounds, is produced. This verbal root remains associated with the act which was being performed during its articulation,

and finally becomes an expressive sign for the entire class of acts during which it is habitually repeated. "Thus would be explained," observes Mueller, "the fact that the primitive Sanscrit roots all express actions and not objects: as actions of digging, cutting, rubbing," etc. Words expressive of other ideas are derived from the first by analogy and metaphor. This theory should also explain why any given root should bear a special relation to any given action, and hence come to express any special group of ideas. It does so, because it has been generated in a cerebral excitation, that has happened to coincide with such other cerebral excitations as have been necessary to the performance of voluntary muscular actions.

Thus, in the figure, *Ar. C.* is placed on a part of the brain that we know is always excited when a person is using his right arm; *S. C.*, on a point very near it, which is always excited when he is speaking. Nerve impulses pass from this point down through the brain until they reach the nerves coming from the base of it, and which go to the throat, tongue, palate, and lips. According to the theory, the excitation or vibration of nerve elements at the point *Ar. C.* spreads to point *S. C.*, the so-called centre of articulation, where it throws nerve cells into some special form of vibration. This special form of vibration is transmitted out of the brain, along nerves going to the lips and other organs of articulation, and the current of air which is at the moment issuing from them is moulded into some special articulate

sound. This becomes a root, an auditory sign, which, first evolved (according to the hypothesis) during the performance of a given act, is repeated with every repetition of the act, and gradually becomes an abstract sign corresponding to the generalized conception of such a class of acts. Thus



W. C. writing centre, *S. C.* speech centre, *M. C.* motor centre for lips, *Ar. C.* arm centre, *C. C.* concept centre (location hypothetical), *A. C.* auditory centre, *V. C.* visual centre.

the first abstraction of speech would result from a generalized experience of a succession of personal actions. In the second stage of development, the sign would be extended by analogy to other actions than the original one; finally to the properties of objects

that seemed explicable by reference to these actions, which were better known than the objects themselves.

Thus, observes Mueller, every root expresses a concept or general notion, or, more correctly, the remembered consciousness of repeated acts, as scraping, digging, striking, joining, etc.[1] As a single illustration. From a root *khan*, to dig, easily came *khana*, meaning not only a digger, but also a hole; and *khani*, a digger and a mine.

I will not dwell on the various interesting facts which might be adduced in support of this theory. But, in considering it, we are led to note the fundamental circumstance that speech implies a more extensive excitation of the brain than does any action performed without speech, including in the latter the systematized thinking which clothes itself in words. In its most rudimentary form, the articulate utterance accompanying a muscular movement implies that nervous action has spread from the nerve centres governing the movements of limbs, to those adjacent centres which control the organs of articulation. Closely adjacent to these centres are other portions of the brain which have no immediate connection with nerves either going to or coming from the brain. The Island of Reil is one of them. These portions of the brain are concomitantly drawn into the vortex of excitement, and when that is the case, the vibrations of nerve cells and fibres which occur during the utterance of the speech, are re-

[1] "The Science of Thought," p. 214.

peated or registered, as it is said, in these extra-sensory centres. It is then, in some mysterious way, that the consciousness or conception of speech is generated in the brain and mind of the speaking individual. The genesis does not occur unless the supra-sensual, superadded convolutions of the brain have attained a high degree of development, and this is why no animal but man is able to speak.[1]

When any one learns the terms of a fully developed speech, or a baby learns his own language, the process is different. Here is no question of generating a spoken sign, compelled to assume an indissoluble relation to some thing. But it is only necessary to learn the spoken sign already created, and the fact that it *is* associated with a thing.

The sound of the word, as bread, falls upon the air and causes a peculiar vibration of the nerve running from the ear to the brain—the auditory nerve. This vibration is transmitted to a special locality of the brain, apparently the first temporo-sphenoidal convolution. Now, if the child has never seen any bread, the sound, though registered, arouses no mental conception; it seems to have no meaning. It is the same when an adult hears a word in a language to him unknown, or when the subjects of certain forms of brain disease hear words after they have lost the power of attaching any signficance to them. But if the baby—to return to him—has seen a piece of bread; if he has become sufficiently inter-

[1] See the most interesting paper of Broadbent on "Cerebral Mechanism of Speech and Thought," *Med.-Chir. Trans.*, 1872.

ested in it to notice the association of this verbal sign with it; if the association has been distinctly pointed out to him, by pronouncing the name at the same time that the bread is shown or given, then another process takes place in his brain. At the same time that the name is registered in this part of the brain, the receptacle for auditory impressions, a visual impression of the object is registered at another point—the cuneus, or posterior portion of the occipital lobes. Often, indeed, the visual impression has been made long before; the child has recognized the appearance of the piece of bread, when it could not as yet name it, but only reach after it with a gesture.

When the two impressions have been registered in the brain—the visual impression of the object, and the auditory impression of its name,—they may then be combined. Exactly how this combination is effected we do not know; but we can represent to ourselves that vibrations, similar to those of the auditory nerve, are transmitted along the fibres which connect these two points of the brain. When this happens, a secondary vibration is coincidently transmitted in another direction to the convolutions "superadded" to the simplest ones which belong to the sense impressions. In these convolutions the more complex combined vibration becomes the material correlative of an ideal concept, composed of the reminiscence of the visual impression of the object and of the auditory impression of its name.[1] Taine

[1] "L'Intelligence," p. 6. The precise statement is as follows: "In the formation of *couples*, such that the first term of each suggests the second

remarks that a couple is then formed, either member of which is thenceforth able to draw the other into consciousness. The sound of the name suggests the image of the object; the sight of the object suggests the sound of the name.[1]

The association of written signs with visual images and with auditory signs is obviously only an extension of the same process, and need not be dwelt on here.

The child learns to recognize a word before he learns to use this word himself; but finally this step also is taken. He articulates the word "bread" under the influence of an internal impulse or desire composed of the sensation of hunger, of the reminiscence of the visual impression of the object, of other impressions or memories connected with it, as of its hunger-satisfying property; finally, of the auditory impression of its name. This complex internal impulse, when definitely formulated, corresponds to an excitation of some part of this intermediate portion of the brain that we may call for convenience, as it has been called, the concept centres. From these centres the excitation spreads to

term; and in the aptitude of this first term to stand wholly or partially *in place of* the second, so as to acquire either a definite set of its properties or all those properties combined, we have, I think, the first germ of the higher operations which make up man's intelligence."

[1] In an interesting paper on "Apraxia and Aphasia," by Dr. Allen Starr (*N. Y. Med. Record*, Oct. 27, 1888), the hypothesis of a "supra-sensual combining centre" is pronounced superfluous. The combination of the visual and auditory impression is said to be *virtually* effected when these simultaneously exist in the brain, and hence in the unity of consciousness of the individual.

that point, whence are innervated the organs of articulation; and when they are excited in the proper way the child is uttering the word "bread." By that time an entire cycle of cerebral activity has been traversed, and the greater part of the area of the brain has been excited. *It is plain, therefore, that to learn the name of a thing, and to learn how to use this name, involves much more mental action than is required simply to acquire sense perceptions about it.* The name, moreover, constitutes an important rise above the level of sense perceptions, and marks the initiation of a process that is to lead to all abstract thought.

The second step in this process is taken when the name of a single object is generalized to others so as to form a class.

Taine tells a pretty story of his little girl to illustrate these early efforts at classification. She had learned to call a lamp "brûle," and was also in the habit of playing hide-and-seek with her nurse, with the exclamation "cou-cou" uttered as the nurse's head disappeared behind her apron. The first time the child saw the setting sun she exclaimed "a brûle cou-cou!" The new object was brilliant like the lamp, and disappeared like the nurse's head. The child imitated the logic of her Aryan ancestors, in combining this new double experience into a single expression containing the two characters of each of the others.

Thus the second step in language is a process of generalization by means of observed analogies. Between individual objects a complex mental concept is formed, existing nowhere in external nature, but only in the mind of a human being holding it. In the act of extending an individual name to a class, the little child passes out of the animal world into the human world; he becomes a rational being. For this reason some thinkers, as Professor Harris, have held that the possession is not only the sign of the soul, but the demonstration of its immortality. Whether this be so or not, the possession is none the less marvelous.

When verbal signs have once become associated with objects, it is possible for the mind to occupy itself exclusively with them, and altogether to disregard the objects. It is as with signs of number, with whose aid most complicated operations can be performed by the mathematician, which would be quite impossible if he were obliged to handle the concrete material objects to which these signs originally referred.

By means of signs, verbal or algebraic, the mind emancipates itself from things; by analogy and metaphor and combination, it contrives to clothe the suggestion of a single root with endless successions of meanings, among which the original significance may be entirely forgotten.

Thus the fundamental fact in the acquisition of language is, that it arouses the activity of the high-

est centres of the brain—the ideal or concept centres without whose functions all knowledge of the external world must remain as isolated groups of sense impressions. Language is essential to all but the simplest forms of thought, because the registration in the brain of a combined impression or personal experience, derived from the union of two or more sense impressions, is always attended by such a diffusion of excitation to the speech centre, that the organs of articulation are called into play, and words are pronounced. This at least is the case while speech is being generated or acquired for the first time. Subsequently, the utterance of speech aloud may be restrained; but none the less is the speech centre thrown into activity, and the word re-echoes in the brain to the footfall of the thought.

The acquisition of foreign languages modifies the cerebral processes just described by rendering them even more subtle and complicated.

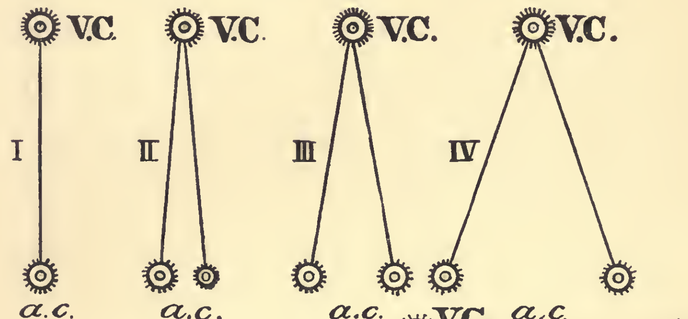
The nervous tissue of which the brain is composed, and to whose structure I have summarily alluded, is composed of an immense quantity of microscopic cells, traversed by delicate fibres, connected with each other by fine fibre-like prolongations of their own substance. By means of somewhat coarser fibres, separate territories of cells, and cells and groups of cells and fibres in the brain, become grouped together It is because of the possibility of infinite variety in these groupings that the possibilities of speech are practically infinite.

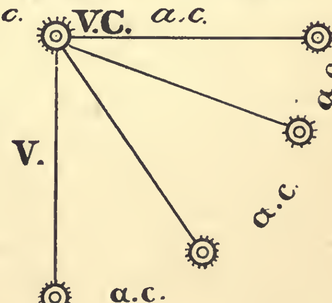
The registration of a spoken word involves, we may say, schematically or provisionally, the excitation of as many nerve cells in the auditory centre as the word is composed of separable sounds. Thus, the word "father" implies two distinct excitations, one for the sound "fa," and the other for the sound "ther." Let us suppose now that another auditory impression be made, for the same object, by its Latin name, pa-ter. This name does not only correspond to the same object; it is philologically identical with the English word, the Latin being merely a modified articulation of the same root and termination. If, therefore, having pronounced the syllable fa, we then pronounce the syllable pa, we must infer that the brain of the person perceiving the difference registers the second syllable in a different, but closely adjacent locality to that registering the first; we may suppose, in the very next nerve cell.

If an object be successively described by two names whose sounds are not identical and which are derived from different roots, then we must suppose that not only different nerve cells, but different, and perhaps rather widely separated groups of nerve cells receive the auditory impression. Thus the English and German names, man and Mann, identical with each other, are entirely different from the Latin and French homo and homme, which are identical. The nerve territories impressed are not, therefore, adjacent, and when the double sets of verbal signs for the four languages become associated in con-

sciousness with the same object, we must suppose that the impulses converging upon the visual centre, to combine with the visual impressions of the object, are gathered from a larger area than when only a single auditory sign has been used.

The area is still wider if there are four entirely different words in the four languages known. The different conditions in the four cases may be represented thus: (It must be remembered that whenever two distant regions are affected, the fibres connecting the two must also be modified.)





V. C. visual centre.
a. c. auditory centre.
I. With single name or auditory impression; *e. g.* the English name plate, without its foreign equivalent.
II. With identical root in two languages and modified termination; *e. g.* homo, homme in Latin and French.
III. With identical root sound slightly modified by articulation into equivalent sounds; *e. g.* pater and father in Latin and English.
IV. With entirely different names or root sounds for the same object in two languages; *e. g.* mensa and table in Latin and English.
V. With different root sounds for four languages.

Adopting the convenient schematic representation of the cerebral process involved, as a vibration and combination of vibrations, we may compare the successive complications to the vibrations of piano strings combined as follows:

I. Tone A combined with tone B.

II. Tone A combined with tone B and semitone C.

III. Tone A combined with tone B and tone C.

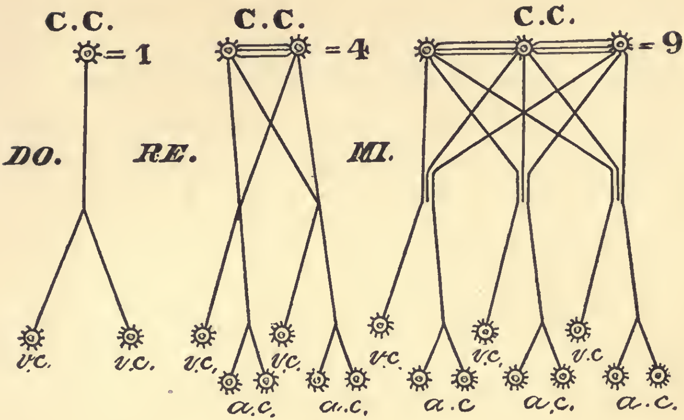
IV. Tone A combined with tone B and tone G.

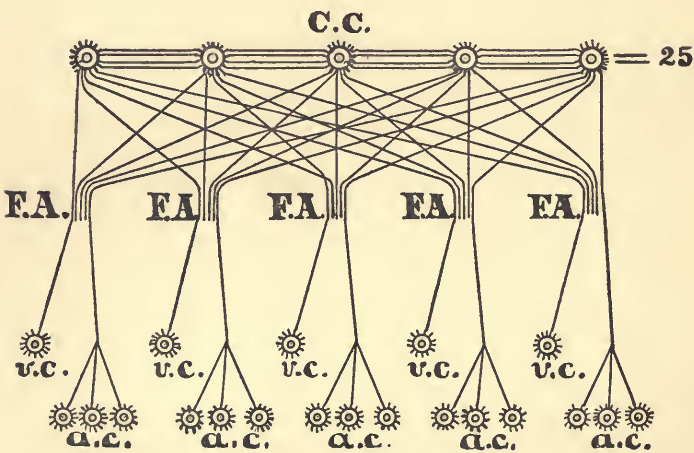
V. Tone A combined with tones E, F, G, in another octave.

The various combinations and extensions of the area of cerebral excitation are effected even while the process remains limited to the instinctive acquisitions of multiple verbal signs, *i. e.*, of two or more languages, by such unconscious effort as a child expends in learning his own or a foreign tongue in the nursery. But in the deliberate study of several languages, the complex combinations effected between the visual and auditory centres are carried up into the ideational or concept centre, there also to widen the area of excitation and increase its complexity.

To illustrate: let us call the first combination above described, *AB;* the second, *ABc;* the third, *ABC;* the fourth, *ABCDEFG;* the fifth, *AB+*, representing extension to another octave, with affection of all the intermediate notes.

These combinations may then be indicated by single symbols, which, to continue the analogy with musical





vibrations, we will take from the musical scale: $AB =$ Do; $ABc =$ Re; $ABC =$ Me: $ABCDEFG$ $=$ Fa; $AB+ =$ Sol.

The more complex the vibration transmitted to the concept centres, or to those parts of the brain

where visual and auditory impressions and their combinations rise into consciousness, the more complex the excitation which will be produced at these latter centres. This is equivalent to saying that there will be a more complex and varied generation of ideal impressions or ideas, by whatever mysterious process that may be brought about.

Thus, in this diagram, let *C. C.* represent the concept centre, thrown into vibration by impressions produced during the various combinations of the excitations of the visual and auditory centres, *v. c.* and *a. c.*

The diagram is intended to illustrate in a rude and approximate way, how the more complex vibration, as represented by the symbols, affects a larger area of all the groups in the concept centres, and also how the intensity of nerve vibrations at these points must rapidly increase. The increasing intensity is represented by the figures 1, 4, 9, 25. The series could, of course, be indefinitely extended, yet must always fall infinitely short of the complexity of the actual process.

To sum up: the acquisition of foreign languages in addition to the native tongue multiplies the number of verbal signs which the mind habitually couples with visual impressions. In registering and in using these multiple signs, the mind is compelled to more complex operations than when only one sign is used. When, in different languages, different primary

words or roots are used to represent the same object, then the mind, using them all, becomes acquainted with the several aspects of that object which have impressed the minds of those among whom these different names have sprung up. Thus a larger impression of the object is formed, and the mind of the speaker, which is rendered more flexible and active by engaging in more complex internal processes, is also enlarged by a richer store of external impressions. This latter effect is proportioned to the degree to which the different language-aspects of the object are thoroughly studied; it may be entirely missed if they are not deliberately studied at all, but words learned only by rote or by habit.

It is finally to be noticed that while the mental or cerebral process increases in extent when multiple names are learned which have no relation to each other, *i. e.*, which come from entirely different roots, the delicacy and finish of these processes is more increased by the study of closely related words, *i. e.*, those with precisely the same root and only modified termination, or those whose identical roots are modified by the introduction of equivalent sounds, as *p* for *v*, *g* for *k*, etc.

The reason for this is the same as for any nervous action, and is conspicuous in nervo-muscular actions. Every one knows the immense superiority in delicacy and subtlety of the movements performed by the fingers as they pass through minute areas of space, as compared with the movements of the arms

or legs, which may extend so much further. And in a similar fact lies the reason for the immense mental discipline to be derived from the study of the European languages, which are all so closely related as to be scarcely more than cognate dialects of Greek, Latin, and Gothic. The discipline is only obtainable when these languages are studied together as simple varieties of the European language. To study them separately and successively is as illogical and time-wasting as it would be to concentrate isolated attention upon peach blossoms or plums, instead of considering at once the great rose family, of which they are members. Neither in the botanical nor in the philological family can the characters of genera and species be understood without incessant reference to the more general characters of the class to which they belong. This reference is even more important for languages than for plants, on account of the incessant transformation of the one into the other, and of the historical phenomena of development and decay which they share in common with living organisms. In the attempt to acquire an empirical acquaintance with apparently unrelated facts, enormous amounts of time are wasted, which would be saved by the scientific insight into the real relations of these facts, with which the study might just as well have been begun.

The first question we have proposed for solution may now be answered thus. There *is* a special effect produced by the acquisition of language, so special

that it serves to distinguish man from the brutes. It depends upon and incessantly develops the ability to use abstract signs as symbols of things, and to use them apart from these things. It is essential to the elevation of the mind above the level of sense perceptions; and itself develops the mental sphere in which ideal conceptions arise, combine with one another, and generate endless successions of new ideas.

The process of acquiring foreign languages, in addition to the mother tongue, modifies the original process, by extending, refining, and complicating it. Impressions are immensely multiplied, and the mind becomes accustomed to take cognizance of such subtle differentiations that its delicacy of perception is indefinitely increased. The capacity to appreciate subtle distinctions, more subtle than those existing in nature outside of the mind, is essential to scientific work. It is also essential to a high grade of ethical culture. Not unjustly have language studies been entitled "Humanities"; for it is the grade of mental development which they foster, that is necessary for the harmonious and finely equitable maintenance of social relations. Without this culture, the study of the external world, even if successfully pursued—which is rarely the case,—is liable to have a materializing and even brutalizing effect, and that in proportion to the complexity of the interests involved. It is very possible for an illiterate carpenter to be a very honest fellow; but it is much more

difficult for an illiterate physician to be truly honorable, even when skilful in his craft.

II.

Language is not the only abstraction to which a young child becomes accustomed. The abstraction of number comes to him very early, and the study of arithmetic should even precede the systematic study of language.

Our second question demanded a comparison of these two forms of abstraction, Language and Arithmetic. The comparison is not difficult to make. Number is a single quality abstracted from objects, to be handled separately by means of its signs. But words represent multiple qualities combined in constantly varying proportions.

When the child first learns the principles of number, it must not abstract this quality from concrete objects; but these are to be handled until a number of concrete visual impressions have been firmly engraved upon the mind.

With words, however, the association with visual impressions, which is so much more complex, must also be maintained for a much longer time. For two or three years, no word should be given to the child or handled by him which cannot be directly referred to sense perceptions; and it is indefinitely desirable to revive their association and to make it as vivid as possible.

Thus, mathematical signs, earlier detached from objects, soon pass into a more purely abstract region than words, from which the image of the object is never completely effaced, and which indeed constitute forever a marvelous transition ground between purely mental conceptions and purely sense impressions. The high degree of abstraction of mathematical signs, however, is balanced by the much greater simplicity of their mutual relations; while the more concrete and sensuous character of verbal signs is associated with an incalculable multiplicity and qualitative variety of interrelation. Hence they bring the mind much nearer to the infinite variety of nature than does mathematics. The abstractions of language prepare for the copious details of natural science and of practical life; the abstractions of mathematics, though essential to the scientific manipulation of these details, are liable, if uncorrected, to unfit the mind for their assimilation. Mathematical training facilitates the working of the syllogism; but language training tends much better to facilitate the discovery of the premises.

Let us now compare the study of language with the study of physical science.

Physical science consists of two parts: 1st, the acquisition of sense impressions through contact with external phenomena; 2d, the collation, comparison, and classification of these impressions, reasoning upon them, and establishment of the laws of phenomena.

The first process collects the raw material of science. But it is the second process that creates science out of its raw material. Science is not nature, but the product of the mind acting upon nature.

Thus the first process in scientific study corresponds to the activity of sense impressions, which for every individual constitutes the earliest form of conscious activity. The second process corresponds to the second step, taken when the mind reacts upon its sense impressions sufficiently to generate words, to create language. Words are the first products of the action of mind upon nature, as science is the latest and most complex expression of the same action. Thus language is the earliest and most perfect type of science. In its threefold nature it offers a threefold type, namely, in words, in grammar, and in literature.

Words, as has been shown, result from the combined activity of several sensory centres in the brain, taken together, or further combined with that of its ideal centres, the latter being, probably, portions of the brain which are not immediately connected with sensori-motor apparatus or with sense impressions. Words may, therefore, be compared to the centaurs of antiquity which were half man and half beast. For on one side they contain the image of external objects; on the other, they consist of a mental gn which has been generated within the brain. Hence, words may be studied in a twofold manner, objec-

tively, by methods appropriate to any study of objects, while subjectively they may be utilized to exercise the mind in handling abstractions not yet disconnected from concrete things.

Now, it is quite impossible permanently to choose, as some people seem to imagine, between study of words and study of things, after the very first steps have been taken. The first steps must certainly consist in direct observation of things, and in training the senses by such observation. This doctrine is very recently enunciated, but now commands general acceptance. We know now that the use of language does not indicate the first activity of the mind, but the second. Education should not, therefore, begin with language, with the alphabet, and reading and writing, any more in the mother tongue than in a foreign language. It should begin with the systematic training of the sense activites that occupy the first six or seven years of life and alone are consciously exercised at this time; the growth of speech, though proceeding with marvelous rapidity, being a quite unconscious process. I have said elsewhere that a child who is taught words before he has learned to handle things is liable always to rank things in subordination to words, a dangerous and often fatal error. But in the handling and observation of things by a young child there soon comes the necessity for a pause. The necessity depends upon two circumstances: the material to be studied is difficult of access; and its important properties are too

complex and too recondite to be made appreciable to the child's senses, consequently not at all to his mind. Because a simple sense perception is possible to a child at the time that a complex mental relation would be incomprehensible, it does not follow that a complex sense perception is more easily appreciated than a simple mental relation. Still less does it follow that it is possible to convey to a child knowledge of many of the most fundamental facts of science, which are not merely phenomena of nature, but complex ideas, composed partly, indeed, of observations of phenomena, but partly also of the inferences, often very subtle, which have been based on these observations.

It is a most ludicrous misconception of the nature of science to suppose that the little manuals and primers which abound for the purpose of disseminating information apart from scientific method, really teach any thing at all. Again, it is a most dangerous preparation for the study of science to call upon children to imagine or represent to themselves facts which have not been apprehended by their senses, or those which could never be. Why should we try to make a child believe that the earth goes round the sun, a statement which contradicts all the experience of his senses? I should rather tell a child, if interrogated, that I have heard that some people said so, but that I myself had no real knowledge on the subject; which is strictly true. Scientific imagination is only permissible to those

whose minds have once become saturated with pictures of real things from prolonged contemplation of nature. The interposition of drawings, schemes, models, diagrams, and the like does not facilitate knowledge of nature, but tends rather to fatally defer the possibility of attaining this knowledge. Hence until the real objects can be perceived, and by means of the real scientific methods, there is nothing gained, but only precious time wasted, in pretending to study them. This same precious time can, however, be utilized in the study of a class of objects which are everywhere accessible in abundance, and whose properties can be rendered conspicuous and intelligible to a properly prepared child of seven or eight. This class of objects consists of words.

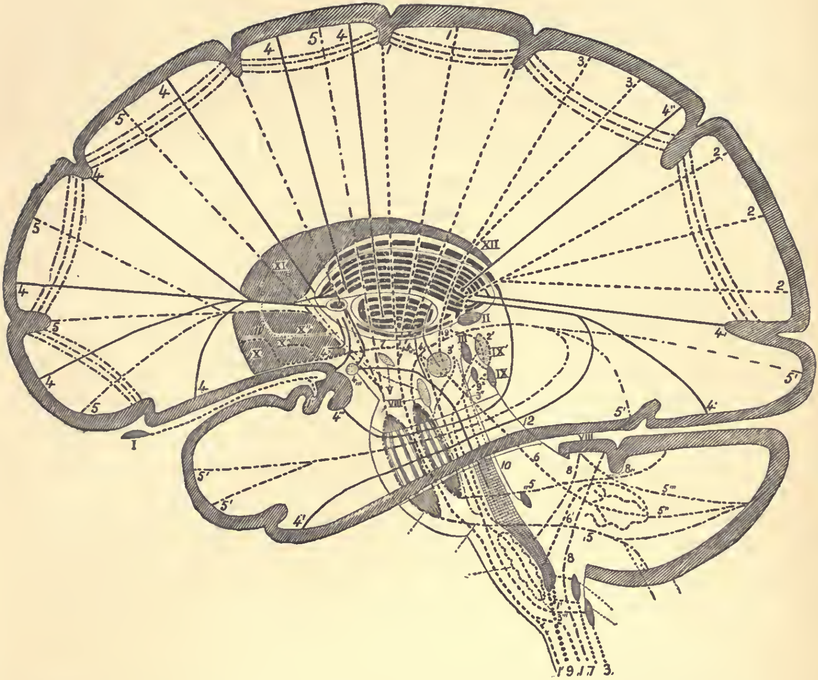
There can be no antagonism between the study of things and the study of words; but the first must initiate education, and the second take it up when further progress in the first has become too difficult. To the study of words, as I propose to show, may be brought the scientific methods used in the study of things—observation, analysis, comparison, classification; and the child may thus begin to be trained for physical science at a time when the pursuit of most physical sciences is impossible.

The purely descriptive sciences of botany and map geography, already begun, may indeed be slowly pursued; but the most strenuous study for the time should be that of language. This study does not

merely serve to occupy the time and to acquire a kind of knowledge necessary for practical purposes at a time when such acquisition is most convenient. But it provides, even in its first stage—the study of words,—a discipline that is quite indispensable to the pursuit even of physical science, whose alleged utility is so often contrasted with that of language.

The habit of handling abstractions, if not exactly essential to the simplest perceptions, is essential to all thought about these perceptions. It is essential also to all perceptions beyond the simplest and most obvious, for the larger part of what the mind perceives is what the mind brings to the object from its previous store of knowledge and reflection. Every word is a condensed generalization of experiences or of observations. Only those accustomed to words are successful in condensing into unity even their own observations ; still less, those of multitudes of other people.

The second part of language, grammar, affords still higher training in the mental processes involved in scientific study. Grammar is the science of relation between conceptions. It is the science of propositions, of the laws whereby words so group themselves in consciousness as to form distinct complex ideas. We have supposed that individual impressions depend upon the excitation of definite areas of brain tissue, and that verbal impressions were peculiar in resulting from the combined excitation of several such areas. A proposition implies the co-



SCHEMATIC OUTLINE OF BRAIN, DIVIDED ALONG ITS ANTERO-POSTERIOR AXIS.—(MEYNERT.)

The lines converging from the surface of the convolutions towards the base of the brain, and marked 1, 2, 3, 4, 5, represent bundles of fibres which pass from the gray matter at the surface to the ganglionic masses at the base, and by the medium of these, to nerve tracts leading outside the brain. The horizontal lines are the association systems of fibres, which connect different convolutions with each other.

incident excitation of a much larger number of areas, and especially in the non-sensory concept centres. The physical basis of the relation of the parts of speech in a sentence to each other we must represent to ourselves to be the vibration of the fibres (the associating fibres of Meynert), which connect these several excited areas and bring them into material relation with each other. (See diagram, p. 91.)

The study of grammar, therefore, differs from the study of words in two ways. It calls into play more predominantly the concept centres as compared with the sensory centres; and it emphasizes the excitation of the connecting fibres of the brain rather than that of the ganglion cell areas which they connect. Grammar, which from a certain standpoint is justly considered to be a branch of logic, disciplines the brain in handling and grouping the impressions which have been registered on it. The discipline thus obtained prepares the mind to similarly group and handle all new impressions; prepares it, therefore, to find a discipline in the material of physical science, as it could not otherwise do. Without such previous training in language, the mind is almost inevitably staggered and confused by the immense mass of impressions it tries to grasp in either physical or moral science.

Literature, the third department of language, represents the action of mind upon nature in a manner co-equal with that shown in science. To enable adolescents to become acquainted with European

literature, it is necessary that in childhood the preliminary work in the lower departments of language, words and grammar, shall have already been accomplished. In words and grammar are already found outlined or reflected the history and the philosophy of European nations. Studied with the same system and method that would be applied to the material of a physical science, words and grammar will lead the child insensibly, but profoundly, into the very heart of literature, and into the central life of the races of humanity that concern him. Until he has touched upon this, his own is incomplete.

The foregoing considerations answer, we think, the second question, which asks a comparison between the educational values of language, mathematics, and physical science.

They also answer the third question, namely, when the study of language may be most profitably pursued. The characteristic time for this study is between the age of seven, as the kindergarten training closes, and the age of fourteen or fifteen, when really scientific studies may be begun.

III.

I have asserted a little while ago that the most characteristic benefits to be derived from the study of European languages are only obtainable if several of them are studied simultaneously, and on the same plan with which we should study the different members of a single botanical family.

The table[1] below shows the division made by modern philologists of the great Indo-European family of languages. Out of these, it is sufficient both for practical and theoretical purposes, to select three branches, the Greek, Latin, and Gothic. From the first two we need Latin, Greek, and French. From the third, English and High German. Knowledge of these five languages is requisite to the real understanding of any one of them; and if these are possessed, knowledge of the remainder, though often most interesting, is unessential, and may be deferred or neglected. Thus, as a modern representative of Latin, either French or Italian, perhaps even Spanish, might be selected; but on the whole, to-day, a practical acquaintance with French is most often required; and, as Milton observed, any one who knows Latin should be able in three weeks to learn Italian.

[1] INDO-EUROPEAN LANGUAGES.

ARYAN.	SOUTHWEST EUROPE.	NORTHERN EUROPE.	
		SCLAVONIC.	
		Bulgarian.	Bohemian.
SANSCRIT.	GREEK.	Polish.	Lithuanian.
	Modern Greek.	Russian.	Old Prussian.
		TEUTONIC.	
IRANIAN.	LATIN.	Gothic (extinct).	
	Italian.	Scandinavian.	
	Spanish.	Danish.	
	Portuguese.	Swedish.	
	French.	Norwegian.	
ZEND.		Icelandic.	
		Germanic.	
	KELTIC.	Low German.	High German.
	Tribes in Spain.	Friesic, Dutch.	English, comp.
OLD PERSIAN.	Gaul.	Anglo-Saxon.	from
	Britain.	Old Saxon.	Anglo-Saxon.
Armenian.	Ireland.	Low German.	Latin.

It is hardly necessary to observe that these languages contain the literature and mirror the thought and life of Europe. Nor is it necessary to dwell on the vulgar error which would distinguish Latin and Greek as dead languages, and hence less useful than modern dialects which may possibly be spoken. To an English-speaking person of any culture, Latin and Greek are far more living than Spanish or Portuguese or Dutch, all spoken languages. Five sevenths of our English vocabulary is Latin.[1] As Professor Harris remarks, we are still living in the midst of Roman civilization. Yet Greek is so much nearer the complex flexibility of modern habits of thought, that Dr. Schliemann might almost be justified in his idea of urging its acquisition before Latin, and as a spoken conversational tongue. Greek is, moreover, as is just beginning to be noticed, a really modern and still spoken language; but this consideration is practically less important than the others adduced.

With which vocabulary from among these languages a child begins his systematic study of language, is almost a matter of indifference. Still, it is usually preferable to select Latin, because its letters are the same as English, as is not the case with German and Greek; because the structure of its words and spelling is most closely allied to English, which is not so obviously the case with French, whose pronunciation also offers peculiar difficulties;

[1] Whitney: "Life and Growth of Language," p. 117.

and finally, because the regularity and simplicity of its grammar render it the language in which the principles of grammar should first be studied. Greek grammar is more complex; French and German, more arbitrary and capricious, especially French. English grammar is atrophied, and as unsuitable as a field wherein to learn the principles of grammar, as the hoof of a horse would be as a model for the study of feet.

It is desirable, when possible, that a child learn instinctively two languages from birth; but it is also desirable that no attempt be made to teach it to speak more than two. Supposing these two languages to be English and German. At the age of six and a half or seven, a dozen lessons should suffice to initiate the child into reading the same, when he is only obliged to translate the new visual signs into auditory signs with which he is already familiar. The initiation once effected, it is quite unnecessary to pursue further special systematic instruction in reading and writing these two mother tongues; knowledge of which will be picked up incidentally, and much faster than by the usual methods. But the child may at once, at the age of seven, begin to read in Latin and French simultaneously. It is not customary to consider this possible, because the study of foreign languages is habitually initiated by the study of their grammar. But this is as unphilosophical as was the former practice of beginning the study of English with spelling and grammar.

Children tend to learn a foreign language by precisely the same process by which they acquire their own. They first learn words, and are so powerfully impressed by the roots of these, which convey all their essential meaning, that they remain perfectly indifferent to their collocation, termination and inflection. If, disregarding this natural tendency, the teacher compels the child to study grammar first, an opportunity to learn a great deal is wasted, and much time is also wasted in learning a very little.

Part of the mistake depends upon the assumption that a child must be taught to speak the language before learning how to read it; and for speaking correctly, a knowledge of grammar and idiom is indispensable. This is the view taken of the modern languages. But another mistake is made when Latin is considered; for as a really fluent reading knowledge of Latin is to-day rarely aimed at, the advantage of its study is often supposed to lie exclusively in the discipline afforded by its grammar. Hence, with French, the child is tied down to endless uninteresting questions about the umbrella of my aunt and the inkstand of my grandmother, in the useless attempt to teach him to speak French correctly; or in Latin is drilled upon the galloping of swift legates from the armed city, so that he shall be able to parse Cæsar's Commentaries. Yet I imagine that even Roman children did not trouble themselves much about legates. And the conversational methods of modern French text-books, often admirably

designed when the time has really come to teach grammar, will, when premature, only serve to suggest to the child, as I heard one say, "that the French must be an awfully inquisitive people to ask so many foolish questions."

The manipulation of a foreign language by speaking and writing it to express one's own ideas is a much greater cerebral effort than is generally recognized. It is an effort that is not demanded at the same stage of knowledge about any other subject. For instance, a student is expected to spend a very long time upon the study of descriptive botany before he would be called upon to invent botanical theorems of his own. Speaking a foreign language is the mental equivalent for thinking out original propositions in a foreign science. The difficulty is usually evaded by the student using some hybrid form of speech, as Roger Ascham long ago remarked was the case with young English children compelled to speak Latin,—or rather in a barbarous gibberish that rather deferred than facilitated their acquisition of the classic speech.

It is the study of words, which corresponds to the descriptive study of the details of a science, with which the mind must become saturated before it attempts to re-arrange their relations into new formulæ. It is the study of words, therefore, which should come first—*not* the attempt to use them, except where the language has been learned instinctively in the nursery.

The words cannot certainly be learned in rows out of a dictionary, but only in connection with their context.

For Latin it is well to construct simple sentences containing only a subject, object, and verb in the third person, which sentences the child must be shown how to read, translate into English, and then write out a translation into French. This can be done at the very moment the child is still learning how to read in English, and an immense amount of time thus be saved. A threefold impression is made upon the mind; the words in the three closely allied languages fuse readily into a complex conception, which retains its several parts much more firmly than when each is learned separately. At this epoch the mind is naturally quickened for the acquisition of verbal signs, and the acquisition of one facilitates that of the rest.

When any set of mutually convertible sentences has been written in the three or four languages, the words in them may be picked out and their roots compared with one another. At seven years old it is quite easy for a child to learn to understand the nature of roots. In his own use of language, as has been said, a child cares for nothing else. He is very much in the condition of his primitive Aryan ancestors. Remembering the fact that to a child any thing may be made intelligible which is appreciable by his senses, it is clear that there should be no difficulty in pointing out to him the affinity of the sounds produced by

the same organs of articulation. He can be easily taught to distinguish gutturals, dentals, and labials, or even the distinction of surds and sonants, and thus to learn the facts at the basis of Grimm's law.[1] In the table below is shown the method of analyzing, for a child seven or eight years old, the Latin words *tectum*, *frango*, and *calidus*, and their philological equivalents in French, German, and English.

[1]T	[2]E	[3]C	[5]T	[6]UM	[1] Dental letters all correspond.
[1]T	[2]O	[4]I	[5]T	[6]( )	[2] Vowel " " "
[1]D	[2]E	[3]CK( )		[6]( )	[3] Guttural " " " and duplicate.
[1]D	[2]E	[3]CK( )		[6]EN	[4] Guttural broken down into i.
					[5] Dental letters correspond.
					[6] Terminations omitted for *toit* and *deck*.

[1]F	[2]R	[3]A	[4]N	[6]G	[7]O	[1] Labial letters all correspond.
[1]F	[2]R	[3]I	[4]N	[6]G	[7]E	[2] Liquid " " "
[1]B	[2]R	[3]EA	[4]( )	[6]K	[7]( )	[3] Vowel " " " or duplicate.
[1]F	[2]R	[3]A	[4]( )	[6]G	[7]I [7]LE	[4] Liquid " " " ; omitted for *break*, *fragile*, and *brechen*.
[1]B	[2]R	[3]E	[4]( )	[6]CH	[7]E [7]N	[6] Guttural letters correspond.
						[7] Terminations omitted for *break*.

[1]C	[2]A	[3]L	[4]I	[5]D	[6]U	S	[1] Gutturals correspond.
[1]CH	[2]A	[3]U	[4]( )	[5]D	[6]( )		[2] Vowels correspond.
[1]H	[2]EA	[3]( )	[4]( )	[5]T	[6]( )		[3] Liquid broken down into u, or omitted.
[1]H	[2]EI	[3]( )	[4]( )	[5]SS	[6]( )		[4] Vowel omitted in others.
							[5] Dentals correspond.
							[6] Termination omitted for *chaud*, *heat*, and *heiss*.

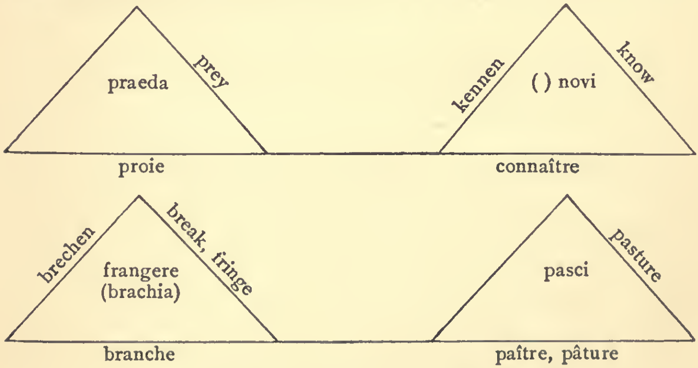
Thence the step is easy to the recognition of the equivalent letters in the corresponding words of different European languages. Practically, he thus learns half a dozen words in the time usually occu-

[1] GRIMM'S LAW.

Original Sound.		Sanscrit.	Greek.	Latin.	Gothic and Low German.	High German.
Aspirates	kh	gh (h)	χ	h, f (g, v)	g	k
	th	dh (h)	θ	f (d, b)	d	t
	ph	bh (h)	φ	f (b)	b	p
Sonants	g	g (i)	γ	g	k	ch
	d	d	δ	d	t	zz
	b	b	β	b	p	f, ph
Surds	k	k	$\varkappa$	c, q	h, g (f)	h, g, k
	t	t	τ	t	th, d	d
	p	p	π	p	f, v	f, v

pied in learning one; learns them with six times the vividness, and is six times less likely to forget them. Philosophically is laid the basis for the conception of central unities diversified by superficial differences, which is one of the fundamental conceptions of both philosophy and science.

In the *Teacher* for June, 1888, I have described a little device for the comparison of verbal roots, which I have called "language tetrahedrons." The child draws one side of a tetrahedron; in the centre of this, as in the centre of a solid body, he writes the Latin word. Under the base line, and thus parallel to the Latin, he writes the French word, when it really has the same root; and on the two other sides, opposing each other, he writes the German and English. The words so taken must always have the same root. If in either of the four languages the object or idea is expressed by a different root, the space for that language is left blank on the triangle.[1] In addition to those published in the *Teacher*, I subjoin some others.



[1] See *Teacher* for June, 1888, New York.

At a later period of study, and when enough grammar has been acquired to render possible the correct construction of sentences, the comparative study of words may be pursued in a somewhat different fashion. A Latin word may be selected from a sentence in which it has been read, and introduced into a new sentence, to be devised by the child. Then sentences in English, French, and German, later in Greek, must be similarly devised so as to introduce the cognate meanings of the same root, with their expressive shades of difference. The system simply extends the method, already in current use, for studying English synonyms. A few examples may serve to illustrate the advantage of this device.

Multas virorum clarorum statuas in templo *posuit* dux.
Je sais *positivement* qu'il va pleuvoir.
We *postponed* going to the pic-nic.

Oppidum obsessum *victus* satis habuit.
There was an old woman, and what do you think,
She lived upon nothing but *victuals* and drink.

Puella regi se *tradidit.*
The boys *traded* marbles with the girls.
Le *traître* a *trahi* le roi.

By such methods, the child, at the end of a year, may be expected to learn from three hundred to five hundred Latin words, and their cognates in French, English, and German. It is not to be presumed that these will be learned beyond the possibility of forgetfulness; but at least the first impression of them

will have been made upon the brain. At the same time a beginning can have been made in reading French, whose resemblance of construction (though not of verbal structure) to English makes it easier to read than Latin. A book interesting to the child must be selected, and the reading conducted exactly as it would be in English: the words spelled by the sound of the syllables, the meaning of each word told, and thus the phrase slowly interpreted. When the interpretation is once complete, the child must read the phrase over and over again, until it can be both understood and enunciated fluently; for until the fluency is attained—and it always can be by sufficient repetition—the phrase does not represent language to the child. The attainment of fluency in the reproduction of the impressions made by the written phrase is not only important in itself, but it serves as a type of complete knowledge in any subject. Any kind of knowledge is only thoroughly grasped and digested when all parts of the brain tissue impressed by it vibrate easily and harmoniously upon its suggestion. In reading words, so long as there is stumbling in enunciation, the knowledge has not risen to the rank of an acquired language, the isolated words have not fused into expressive speech.

It is to facilitate fluency, that for at least two years the teacher must supply the place of the dictionary, and tell the child the meaning of each new word. At most, when a word once learned has been forgotten, he may be led to refer to the previous

phrase, and to recall the meaning from the context. It is indeed always desirable that the meaning of new words be divined as much as possible from the context. It is wrong to condemn this as reprehensible "guessing" and fatal to accuracy and thoroughness. The act implies an effort of the mind to revive faint reminiscences and to detect faint associations of ideas; it is the very act involved in scientific research after new truths. The teacher must of course be on hand to test the accuracy of the guess, and correct it if wrong or flippant.

The child should not at this period be left to himself at all. Argument as to what is intellectually possible for a child, must not assume that he is to be thrown upon his own resources to interpret the French or Latin page. Such independent work comes later. But the business at first is *not* to train the mind in self-reliance, but to saturate the brain with impressions, and to habituate the ear to a new form of speech. This must be done under guidance, as clay is moulded by the guidance of the sculptor's hand.

With such guidance, Latin—its construction somewhat modified—may be read with but little more difficulty than the French or German. It is essential that the child become accustomed from the beginning to at least the easier peculiarities of Latin construction. It is pitiful to see scholars, after many months, even two or three years of study, still stumbling over Latin sentences, in the attempt to

read them in the English order, to turn them, as it is said, "into good English." Now in order to penetrate fully into the spirit of a language, it is necessary at the moment of enunciating it, to banish all recollection of any other language from the mind. It must *not* be translated, or the habit of translation must cease as soon as possible. Then only is it evident that the mind places its different groups of verbal signs on the same footing. One great value to be derived from a fluent acquaintance with Latin and Greek is, that in passing into the unfamiliar construction, the mind passes into a separate consciousness; and by so much enlarges the range of its own experience. This cannot be done to the same extent by means of French, German, or Italian language, because their construction too closely resembles our own.

After two years' study of words, and when by repeated practice, some empirical reading knowledge of French and Latin has been obtained, the child may enter upon the second part of language, the study of *grammar*.

The fundamental peculiarity of grammar has been pointed out. It is concerned with the relations of words and ideas, quite separated from their sensory origins; concerned with processes that take place exclusively in the concept centres of the brain. These are called into function to a much greater extent than is the case even in regard to words, which

indeed transcend sense impressions, but not to the extent to which the conception of verbal relations does.

It is perfectly absurd to make a child study grammar until its mind has been well stored with impressions of words. And, on the other hand, it is equally absurd, and a great waste both of time and of fitting opportunity, to defer the study of words until the mind has become ripe for the study of grammar.

Why French grammar should ever be learned before Latin, I have never been able to understand, yet I know it is often done. A large part of its subject-matter consists of idioms and conventions, whose reason lies in the historical development of the language, and not in logic. Now a child is capable of logic long before it is really capable of history. To teach French grammar before Latin, is to accustom the child to take accident before necessity, and convention before truth, a most fatal habit of mind. The two grammars should be studied simultaneously.

In considering grammatical inflections, the child learns to develop an idea whose germ had been previously acquired, namely, that the essence of the word lies in its root, and that the termination is a varying modality. But to fully appreciate this fact, the child must be led to discover the inflections and their groupings for himself, and not confronted at the outset with lists of declensions and conjugations

to be learned by heart. This universal practice is, from a psychological point of view, simply barbarous. By a scientific method the child should be led to deduce the inflections from his own observations of the facts of the text. Reading the same word in many different connections, and being obliged, by the context, to translate it differently each time, the child can be led to notice the different termination which corresponds to each translation. From these various observations he can gradually build up for himself, of course under guidance, a complete scheme of the five declensions. Much more time is thus consumed than in the ordinary method of learning these declensions by heart. But, on the other hand, the child repeats the process by which the grammar was originally constructed, and what is still more important, he becomes acquainted with the method which is typical for all scientific study: he collates scattered facts, brings them together, observes their relations, and establishes their law.

The same method applies to the more difficult study of the verb. But here three degrees of generalization are to be observed, that of person, of tense, and of mood. The first distinction is the most general and the most easily appreciated. The extreme regularity of the person terminations in the Latin verb makes them an easy subject for drill. After they have been discovered and established, the distinctions of tense may be similarly dealt with: first, in their broad distinctions of past,

present, or future time; later, in the subdivisions of past and future time, that for a long time must seem to the child unnecessarily subtle. Even more subtle are the modifications of assertion implied in moods. I do not think the distinction of indicative, subjunctive, and infinitive mood can really be made intelligible to a child under eleven or twelve years of age, if it can then. But, nevertheless, these moods can be studied descriptively at eight or nine, when they are not explained, but merely characterized by the English auxiliary words used with them, *may*, *might*, *to*, etc.

The inflections of nouns and verbs furnish the child with conceptions of scientific classification at a time when, as already pointed out, these cannot be obtained from physical science. They furnish types of more abstract classification than is afforded by study of word roots, for inflections represent modifications of roots corresponding to modifications of the mind perceiving them. The mind does more than perceive—it handles these roots; it freely manipulates for its own purposes what has hitherto been presented to the child in a purely objective aspect. When a child learns a language on its subjective side first—learns by habit to speak and use it as a tool, he loses the immense impression obtainable when words have first been studied objectively, as classes of things having a real and independent existence; and the mind is afterwards seen to establish a free dominion over these same things, moulding them to its own

purposes, yet leaving their essential nature undisturbed. Here is a splendid type of the action of the human mind in nature, whose details, once conquered, may also be inflected to express human meanings.

When the inflections have once been learned, the child must change his mode of reading. He must no longer be told the meaning of words, nor allowed to divine either the root meaning or the mode from the context, but he must infer the precise interpretation of each word and of the entire sentence from these inflected terminations.

It is generally recognized that this act of inference or reasoning is an important mental exercise. Indeed, teachers are rather liable to err on the side of thinking that this is the only kind of mental discipline, and that it is, moreover, the chief value of learning Latin. Neither assertion is true, but the value of the inference is nevertheless great. In it the fact observed, as for instance the termination of the genitive case, is first associated with previous impressions of other similar terminations and the similarity recognized. Then associated circumstances of these previous impressions are revived in memory, as the fact that the termination belongs to such a declension, and is translated by the word "of" in English. The association of these circumstances is transferred to the new impression which has been placed in the same class, and the word therefore interpreted as the others had been.

Acts of inference always imply a similar revival of past impressions, principal and accessory, and their fusion with the impression newly received. They powerfully exercise the mind because they fuse scattered excitations or vibrations into energetic unity. The inferences demanded of the child in translating Latin are simply the type of mental acts that are to be demanded of him all his life, and constitute an excellent preparation for these. The logical value of French and German is so much less, because precise knowledge of construction and inflection is unnecessary to the interpretation, and the general similarity to English, renders much narrower the space traversed by the mind to reach the point of view of the foreign consciousness.

All grammatical subjects must be studied on the principles laid down for study of the inflections. The laws, as far as possible, must be deduced from observation of the facts, and not announced categorically, with the facts adduced in illustration. Grammar must be carefully kept subordinate to language considered as a means of expression and communication.

I often think that the feeling for Latin literature is as much injured by excessive drill in parsing, as the literary appreciation of Milton was impaired by the old-fashioned drill in "Paradise Lost." The study of grammar as a complete and highly abstract science properly belongs only to ripe minds—at earliest, to the period of adolescence.

For children under fifteen, only just so much grammar should be required as is essential to the accurate interpretation of what is read, and to the power of approximate accuracy in writing.

For young children, the selection of grammatical subjects in the order of their real comprehensibility to the growing mind is a delicate, but most interesting task. Two principles should guide the selection. First, that ideas are easy for the child in the degree to which they approach or involve sense perceptions, or concrete conceptions, and are difficult according as they recede from these and become generalized. And second, that grammatical laws and rules are impressive in proportion as they seem necessary; and unimpressive, therefore difficult to remember, according as they relate to what seems unimportant, that is, to whatever is unessential to the interpretation of the sentence. Hence the parts of speech which modify the noun and verb are much more difficult to learn about than the noun and verb themselves; and it is illogical to place the study of the adjectives, and especially the study of their comparisons, before the study of the verb. Similarly for adverbs, conjunctions, and prepositions, and for all devices for linking words together, and for which the child does not feel the necessity. Similarly for the relations of the parts of a sentence to each other, the discussion of subject and object, the management of the infinitive mood in its relations to the moods of other verbs and to the accusative case; similarly with a host of

other subjects that will readily suggest themselves to an experienced teacher, if examined by the test of the principles above stated. A child can become cognizant of a great many grammatical facts at an epoch when it would only be bewildered by the abstract law of these facts. It is easy to learn the fact that if a person or thing is said to be doing any thing, the name of this person is put in the nominative case; and this may be intelligible in Latin, when it is quite unintelligible in English. But, at the very same time, the child may be utterly bewildered by the statement, "The subject of the verb must be put in the nominative case."

Again, it is easy to explain the relations of the subject to an active verb, when it is still very difficult to explain the passive verb or voice. I have noticed that children have the strongest tendency to put the subject of the passive voice in the accusative, because they declare (and with logic) that "something is being *done* to the person." And I think it is hopeless to demonstrate that the terrible verb "to be" is a verb at all. The fact can only be learned empirically, and all explanation of it sedulously avoided. The child confounds this verb with an adjective, and in doing so merely reverts instinctively to the fundamental conception of the predicate, out of which the verb and adjective have diversely sprung. On the other hand, the picturesque expression of "strong verbs," applied to the famous eleven irregular verbs in Latin, can be easily appreciated

by the child, as indicating words worn into irregularities by constant use.

In all study of grammar under the age of twelve this rule should dominate: let nothing be learned but what is essential to the interpretation and manipulation of the language, and defer philosophical grammar to a ripe stage of mental development. The energy often wasted upon premature study of grammar is much more profitably occupied in acquiring fluency in language.

The slow, deliberate, and thorough accumulation and manipulation of verbal impressions enriches the brain. But it is the rapid and instinctive manipulation of such impressions that renders the mind agile and flexible, because it accustoms the brain to the rapid and multiple propagation of excitations, and their varied combinations into secondary excitations.

So far nothing has been said about learning Greek. I think that this should be begun gradually, between the ages of ten and twelve, at first merely by learning proper names and the words cognate to the Latin roots, as these are successively studied. By the age of twelve, a sufficient fluency in the capacity of reading and writing French should have been acquired to justify dropping its study for a while, and substituting the systematic study of Greek, this to be pursued most strenuously during the next four years.

The general construction of a language exhibits on a still larger scale than does its elementary gram-

mar, a process of cerebral synthesis in which the "association" fibres of the brain are involved, those namely which connect separate convolutions with each other. Every special form of language construction depends upon a special grouping, not merely of different areas of cells, but of different convolutions, of distinct territories often widely separated. We may compare these different regions to groups of battery cells, standing on different tables in a laboratory, and labelled A, B, C, D, etc. These groups may be brought into a circuit in various ways according to the order of their connection with one another. Thus we may have,

A + B + C + D, or
A + C + B + D, or
A + D + C + B, or
B + C + D + A, etc.,

the variety depending on the laws of permutation.

The different permutations correspond to the different modes in which separate brain regions may be brought into connection with each other, in the general synthesis of cerebral activity that effects the expression of speech according to the construction of a special language.

When a person, habituated to one form of construction, learns to understand fluently, to think, and still more to speak under another form, the functional grouping of these brain regions must be changed. Though the anatomical architecture of the brain remain the same, its functional relationships are

rendered different. This change, like all changes for nervous tissues, constitutes an immense stimulus and excitation, proportioned to the extent of the change. To consciousness, the mind seems to have traversed a certain space to place itself at the new point of view. The physical basis of this consciousness is the space occupied by the nerve fibres of the brain, which propagate vibrations from one convolution to another. When an English-speaking person projects his consciousness into the form of language construction peculiar either to Latin or Greek, he seems to traverse a much wider space than if he simply pass from English to French, or even to German. The re-arrangement of direction for the intra-cerebral propagation of vibrations or excitations must therefore be much more extensive for the ancient languages than for the modern. Hence the mental development, or cerebral stimulus derived, must be much greater.

The special values of the study of Latin over the modern languages may now, in answer to our question, be categorically stated.

1. No European language, and no European history or philosophy, apart perhaps from the Sclavonic and Scandinavian groups, can be understood without knowledge of Latin.

2. Least of all can English language, philosophy, or history be understood, since the language is simply a combination of Anglo-Saxon and Latin, in which Latin considerably predominates, and Rome is in-

delibly impressed upon English history, thought, and institutions.

3. In the study of words, which should initiate the child into the study of language, the Latin roots are best fitted for beginning, on account of their familiarity, conspicuousness, simplicity, and ready manipulation.

4. The Latin grammar is the most perfect grammar of Europe, and should alone be used to teach grammatical principles, selected in the order of their natural comprehensibility for the developing mind.

5. The construction of the Latin language as a whole compels the translation of the modern mind into a form of consciousness sufficiently remote from its own to necessitate a great change in the general synthesis of cerebral activity. The same is true of Greek. The change constitutes a powerful mental exercise and brain stimulant.

To obtain the full value of the study of Latin and Greek upon the development of the brain, must be applied the principles that are now generally, though half consciously, invoked in the acquisition of the mother tongue and of modern languages, namely, that the synthetical impressions of the language as a whole must be copiously stamped on the brain before the pupil is called upon to analyze the language.

This is to be done by means of *much* and *rapid* reading. Roger Ascham tells us that Queen Elizabeth became a good Greek scholar by every year reading entirely through the works of Demosthenes

and of Isocrates. The reading must be on a subject interesting to the child; hence it is scarcely possible that it be directed to classical authors usually chosen for a school curriculum. It is the fashion among some teachers to denounce "readers of manufactured Latin," and declare "that the sooner a boy can draw his Latin from the living spring of a classic author, the better."[1] This principle may or not be correct from the point of view of the Latin scholar, but from the standpoint of the physiologist and psychologist it is certainly absurd. We do not forbid English children to read English until they are capable of understanding Milton; or French children to read French so long as they fail to understand Jomini's "Art of War." It seems improbable that Roman children were ever schooled upon Cæsar's Commentaries. It would be a poor commentary upon the results of the Latin scholarship of so many centuries, to assert that there are now no scholars capable of writing Latin in a way that should gradually initiate young children into the difficulties of its construction, while accustoming them to look upon Latin as upon any other languages, as a medium for communicating interesting ideas, and not merely as gymnastic exercise for the intellect, concerned with ideas to which the child must be indifferent.

An immense number of Latin idioms can become

[1] "Six Weeks' Preparation for Reading Cæsar." Note to teachers on first page.

familiar to a child in the same way as French idioms do, by the process of repeated observation of them in the course of reading, and this at a time when the abstract, the scientific statement, or law of those idioms could not really be grasped. Familiarity with the fact should logically precede analysis of the fact. Reversing this process, as is usually done, may make grammarians; but, unless the study is prolonged many more years than is usually practicable, it does not enable the student to read the language. It is very rare to find that a boy or girl who has begun to study Latin at twelve can read Latin fluently at sixteen, though far more time is given to the study in these four years than should be the case, for they are too precious and too much needed for other things. If during the four years preceding twelve, familiarity with the phenomena of Latin had been acquired by frequently repeated observation, the subsequent scientific analysis of these phenomena, *i. e.*, the grammatical study of the language, would be ten times as fruitful of result.

The development of our subject has insensibly furnished the answer to another of the questions started at the beginning of this essay. It is necessary to maintain a just proportion between the study of languages and the other studies of a general curriculum. The effect on mental development and training is to be obtained, if at all, by the age of fourteen, fifteen, or sixteen. By this time the pupil requires

the broader and more robust discipline of other knowledge, pursued with the thoroughness of scientific method which will then be practicable. It is undesirable to continue the systematic study of languages at this time; they should be dropped altogether, although the habit of reading in all may be most profitably kept up, and other subjects, especially history, studied through their medium.

All that has been here said on the physiological value of the study of language applies to the developing mind—to the stage of development at which signs are being coupled with things, and the "mental couple" raised to the concept centre, and accepted as a unity in consciousness. For the adult mind, accustomed to the use of signs, the acquisition of a foreign language can have no such educational significance. It is true that an adult who has had no training in language, finds such difficulty in undertaking the study of any thing else, that he is best advised to acquire a language, especially some knowledge of Latin, before attempting any other study, especially that of medicine. But he cannot derive the same relative benefit from learning the language then as if he had learned it as a child. Moreover, in learning the language, the time is relatively wasted that might be more appropriately spent in learning to grasp larger and more complex groups of facts and ideas than are presented in any but the really philological study of language.

Hence, one great reason for teaching children a

reading acquaintance with four or five languages between the ages of eight and fourteen, is that by the latter age they may really know these languages, and then begin to study something else more difficult, or of more immediate practical utility.

Nevertheless, some study of language must always accompany all other studies. Language which alone perfectly expresses all internal thought, also mirrors all external things as they have ever impressed the mind of man. Language, speech, is thus truly the Logos, the intermediary between the soul and the world. It is at once the thought made flesh and flesh sublimated into thought.

But advanced philological study should be regarded as distinctly a specialty, as is the advanced study of philosophy, or of chemistry, or physics, or physiology, or any other science. That a youth must have, or pretend to have, a perfect knowledge of Latin and Greek before he attempt to acquire even a smattering acquaintance with the world around him, is certainly a traditional superstition. But by the method of language study which has been here advocated, the student may really experience the discipline conferred by language training, may enjoy the immense practical advantage of admission to all European literatures, and yet secure time for a correlatively liberal education in other directions, equally important.

THE END.

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